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QUEENSLAND AGRICULTURAL JOURNAL

VOL. XXX. 1 DECEMBER, 1928. PART 6

Event and Comment.

Benefits of Organised Marketing.

IN his report to the Minister for Agriculture (Mr. W. Forgan Smith), the Director of Marketing (Mr. L. R. Macgregor) says that with organised marketing supply can be measurably controlled, demand stimulated, and new markets developed, but complete price stabilisation is difficult of attainment. Economic and climatic influences so operate that even with complete control of a commodity, prices at times must fall, and the primary producer suffers as a result. It appears, however, to be unquestionable that some Queensland agricultural industries would be non-existent but for collective marketing, and all which are subject to control have been materially benefited. There is an increasing support of organised marketing among Queensland primary producers generally. So far there is every indication that the system of collective marketing has become an integral feature of Queensland agriculture.

Objective of Agricultural Organisation.

THE Queensland plan of agricultural organisation dates from the year 1922. In that year comprehensive organisation of farmers was provided for, and the support by the farmers throughout the State of the principle of organisation was enlisted by the establishment of over 700 local producers' associations. The objective was to encourage farmers to co-operate in all matters pertaining to agricultural well-being. The improvement of marketing conditions was adopted as the immediate objective, and in the attainment of which the support of the rank and file of the primary producers was necessary. The objective of organised marketing was adopted, not because that is the only sphere in which farmer organisation can bring benefits to

the farmers, but because it was the sphere in which the advantage of unity of purpose in the attainment of a common object was felt to be most readily demonstrable. Further, it was foreseen to be the objective for which the support of the agriculturists themselves would most readily be forthcoming.

Widespread Character of Controlled Marketing.

AT this time last year thirteen of the main primary products of the State were being marketed under organisation, and that is the position at present. Taking the annual value of the agricultural production of Queensland and reckoning the products which are subject to the system of controlled marketing, it may be said that approximately three-fourths of the annual value of the State's production have been brought under the system.

The Poultry Industry.

THE marketing of eggs is fraught with especial difficulties in excess of those which apply in the case of most primary products. The Egg Board's problems are greater than those of any other commodity board. Following are some points in connection with this matter:—

(1) The product is highly perishable and, although there are peaks and depressions in production, it is nevertheless more or less continuous. In fruit, which is another perishable product, there is a seasonal production, but in the case of eggs there is no period in which the production drops to nil.

(2) For a good many years the production of eggs in Queensland has been in excess of local demand. During the past financial year production has increased by 20 per cent., necessitating an increased utilisation of interstate and overseas markets with resultant costs. As a consequence of such increasing production, the endeavours of the Board and its agents have been severely taxed to hold the market.

The Egg Board is concentrating upon an endeavour to reduce the variation of price that exists as between the period of short supply and of flush production. The Board realises that there would be a greatly increased consumption of eggs on the local market if the price could be prevented from rising to the high figure of 2s. 10d., at which price it is impossible for many consumers to buy. A stabilised price would level up consumption on the local market to higher figures all the year round. The Board is seeking to restrict variations in price, but the increasing production of eggs is proving a serious handicap.

Canary Seed.

THE market conditions for canary seed this season have been singularly unfortunate. Shortly after the inception of the Canary Seed Board there was a fall in world values to £16 10s. per ton for Argentine seed on 15th March. Imported canary seed was offered at that figure by importers at a uniform price at all Australian ports. The Board was forced into the position of having to consider meeting the competition of the imported article, or, in the alternative, of holding seed indefinitely for higher values. Merchants had the opportunity through the importers of booking up imported seed at the low values ruling in the month of March for spread delivery during the ensuing months. If, therefore, the Board had not met this competition its market would have been cut off for months ahead owing to the bookings by merchants of imported seed. The holding of the seed would have necessitated the Board incurring storage and interest charges for at least a year, with no certainty then that the market would have improved by that time. It was therefore decided to sell canary seed competitively with the imported article. The only advantages, therefore, which the producers have had through the Canary Seed Pool this season are—

(*a*) The full advantage of the protective duty of £8 8s. per ton.

(*b*) The advantage of the cleaning and treatment of the seed at rates cheaper than would have been available to the individual.

(*c*) The price has been held at import parity, notwithstanding considerable importations; whereas in the absence of a pool, if merchants had been fully booked up with the imported article, the probability is that the local production (without control of the market) would have fallen to less than import values.

The Peanut Industry.

THIS industry continues to develop. Up to the present time, pending treatment and sale, the nuts have been stored at farmers' barns and various other unsuitable locations, and, as a consequence, consideration has been given to the erection of a modern storage and treatment plant. This plant is now in course of construction, and it is estimated that it will be completed in the beginning of 1929, and that it will be available for next season's crop. The plant will enable the more economical handling of the product. It will also make safe storage available, and improve the grade of the product placed on the market.

Production Problems in the Dairying Industry.

WITH the apparent return of more favourable climatic conditions, a focussing by the dairying executives of the attention of their constituents to production problems is urgently desirable. It is not yet fully appreciated by dairymen that an increase in the production per cow is capable of exerting more direct influence in increasing their monetary return from the product than is readily attainable by an artificial raising of price, so long as export exceeds local consumption. This is more noteworthy as regards Queensland than in the case of any other Australian State. Even if the objective of an all-Australian price is attained, dairymen, in a State such as Queensland which exports annually about two-thirds of its production, will always be handicapped in comparison with dairymen in a State like New South Wales which consumes most of its own production.

The objective of increased production per cow may be gradually attained by the application to production problems of the same enterprise and vigorous organisation methods as have been manifested by Queensland producer leaders in co-operative manufacture and marketing, and in particular by the application of these methods to—

(1) The undertaking by L.P.A.'s in dairying districts of herd testing.
(2) Rigorous culling of unproductive cows.
(3) The use by producers of the facilities which exist whereby dairymen may secure bulls of high producing strains, including the Departmental Better Bull Scheme.

It is admitted that bad seasons are discouraging to dairymen taking active steps in the directions indicated, but the return of good seasons renders it timely for L.P.A.'s in dairying districts to encourage their members along these lines.

Deciduous Fruit.

THE position of the deciduous fruit industry as engaged in largely in the Stanthorpe district has been carefully reviewed during the past year. Some points in connection with the matter are:—

(1) The total number of packages sent from Stanthorpe to Brisbane for the 1928 season was 649,838, as against 450,837 for the year 1927, the average number of packages per Stanthorpe grower being 1,000 for approximately 700 growers.

(2) There has been considerable development in the despatch of quantities direct from Stanthorpe to the provincial centres.

(3) Deciduous fruits for factory purposes were formerly purchased haphazardly, some being despatched direct from grower's station to factory, but a considerable quantity was purchased from the market. Second-grade fruit is suitable for manufacturers' requirements, and a freeing of the fresh fruit market of the second-grade fruit in question automatically improves the market for the better-quality fruits.

(4) The quantity sent direct to factory in previous years was a fraction only of 1 per cent. Last year the quantity sent direct to the factory was 6 per cent. of the total, the figures being—

	Tons.
Direct to fresh fruit market	10,969
Direct to factory	698
Total	11,667

Thus it seems possible to increase the proportion sent direct to the factory to probably 10 per cent. It is important to note that the fruit sent direct to factory is the second grade, which exercises the greatest depressing effect on the market. Further, a surplus of 10 per cent. will frequently depress the market out of all proportion. The market, therefore, is being relieved to a greater extent than the percentage actually shows.

Bureau of Sugar Experiment Stations.

BIOLOGICAL CONTROL OF CATERPILLARS ATTACKING SUGAR CANE.

Mr. E. Jarvis, Entomologist at Meringa, near Cairns, has submitted the following report for the period, October to November, 1928, to the Director of the Bureau of Sugar Experiment Stations:—

Amongst the numerous natural enemies belonging to class Insecta, which wage perpetual warfare against the caterpillars of various species of the order Lepidoptera, a few of the so-called "ground beetles" (Carabidæ) occurring commonly in our canefields happen to be of decided economic interest.

About a couple of months ago (15th September) the present writer confined a specimen of *Rhytisternus carpentarius* S. in a small breeding-cage, in order to make a preliminary study of its range of dietary whilst under confinement. This carab measures about 18 mm. in length (nearly three-quarters of an inch), and in general appearance is lustrous black, with exception of the antennæ and tarsi which are dark reddish, the latter being provided with stiff hairs. The upper surface of the body is flattened, the elytra having about twelve decided dorsal striæ, and about three striations on the sides of each elytron.

At intervals of from four to seven days the following miscellaneous insects were killed by and greedily devoured by this predaceous beetle—viz., two large sarcophagid flies; a caterpillar of *Cirphis unipuncta* Haw. ("Army Worm"), about 1¼ inches long; a grub of *Isodon puncticollis* Macl. in the third instar; a pupa of *Dichocrocis punctiferalis*, "Peach Borer"; two cockroaches, *Periplaneta americana*, and a smaller arboreal species; and a caterpillar of *Laphygma exempta* Walk.

Each of these insects was put into the cage during the afternoon, at which time the beetle was hidden in the soil under a stone, and was usually found to have disappeared by the next morning. The harder chitenous portions, such as the head and mandibles of larvæ and wings and elytra of the dipterous and orthopterous insects respectively, were invariably rejected.

Perhaps our most useful species of "ground beetle" will prove to be *Chlænius australis* Dej., some of the predatory habits of which were recorded by the writer for the first time in the year 1921 ("Queensland Agricultural Journal," vol. xvi., p. 278). Both the adult and larval forms of this insect were observed destroying caterpillars of the "grass worm" *Laphygma exempta* Walk., which during February of 1920 inflicted great damage to the leaves of young cane and maize plants at Meringa, near Cairns.

These predaceous larvæ occurred quite commonly in this affected area, attacking principally the caterpillars traversing the bare ground between cane rows, but also exploring the leaves in search of prey. Upon encountering a caterpillar the predator instantly buried its powerful cutting mandibles deeply in the body, near the head, and then simply hung on, while the unfortunate victim vainly endeavouring to shake off its foe, twisted and rapidly rolled over and over convulsively. Such struggles seldom lasted more than a minute, at the end of which time even large caterpillars seemed too weak to offer further resistance, and suffered the enemy to greedily imbibe their life juices until its body had become greatly swollen and could hold no more.

The larvæ of *C. australis* run with agility, being exceedingly active and pugnacious. When alarmed, they hide in small holes or sun-cracks in the dry earth. Specimens captured in the field and fed upon noctuid larvæ and pupæ pupated at the bottom of breeding-cages under damp soil. The pupal condition during March (one of our hottest months) lasted only seven days; the mean shade maximum temperature at the time being about 87 deg. Fahr.

Scientific descriptions of the larval and pupal stages of this beetle need not be given here, but I may state that in general appearance the larva is uniformly black, of typical campodeoid form, and slightly exceeds half an inch in length. This beetle is about 15 mm. long, with pronotum and head shining green and deeply punctulate; wing-cases dark brown, edged with green, and often suffused with iridescent pink; each elytron with eight parallel rows of punctures. Legs and ventral surface of body shining black; palpi and basal joints of antennæ reddish-brown.

In a paper dealing with the "Economic Value of Certain Queensland Parasitic Insects," contributed to the Pan-Pacific Congress held in Sydney during August, 1923 ("Queensland Agricultural Journal," vol. xxii., p. 115), the present writer advocated the introduction of this useful predator into other countries desirous of enlisting its services in connection with biological control work.

It is of interest to note that during 1919 a species of *Chlænius* (probably *C. australis* Dej.) was introduced into Hawaii from North Queensland by the Sugar Planters' Association; presumably for the purpose of combating army worms. Several species of this useful genus of Carabidæ perform valuable services in other parts of the world against various lepidopterous insect pests. *Chlænius tomentosus* Say., for example, helps to control the ravages of the so-called "Tobacco wire worm" (*Crambus caliginocellus* Clem.) in Virginia, and is believed also to be predaceous on the grubs of *Lachnosterna* in North America; while *Chlænius dichrous* destroys caterpillars of the familiar "Codling Moth" (*Cydia pomonello*) in South Africa.

In addition to *C. australis*, alluded to above, two other species of this genus are not uncommon here in canefields, viz., *C. flaviguttatus* Macl. and *C. ophonoides* Fairm., both of which should be protected by the grower when noticed in plough furrows.

Ænigma cyaneum Cast. is another of our farmers' friends, and may be easily distinguished from the foregoing species by its lovely bright blue wing-cases. The metamorphosis of this beetle is being studied at present at Meringa Experiment Station.

Emergence of Greyback Cockchafers.

The month of October was a very dry one, our registration at Meringa Experiment Station being eleven points, instead of 1.84 inches, which is the average rainfall for the Cairns district for this month during the last forty-five years. November, however, saw a change in the weather, and up to date (14th November) we have recorded 8.93 inches at Meringa. This welcome rain was accompanied by much cooler conditions, the mean shade maximum temperature during the period 11th to 14th November being 81.75 deg. Fahr., while our average for the entire preceding month (October) was 91.6 Fah. It is interesting to note that the latter temperature was unusually high for October, seeing that our average for this month during the last five years happens to be 87.92 deg. Fahr.

A few odd specimens of greyback cane beetles have already appeared on the wing, the earliest capture recorded being on 4th November. Up to the present, however, the main body is still below the ground, but may be expected to emerge directly weather conditions favour commencement of the flighting period.

RELATIONSHIP BETWEEN INSECT ATTACK AND PLANT FAILURE

The Southern Assistant Entomologist, Mr. R. W. Mungomery, has submitted the following report for the period October to November, 1928, to the Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby:—

Generally speaking, cane which has been planted in spring is, to a greater extent, more subject to the attacks of insect pests than autumn-planted cane. This condition is applicable to the Southern part of Queensland, where these two distinct planting seasons are chiefly recognised. This state of affairs is not to be wondered at when it is remembered that spring represents the time when practically the whole insect world is waking from a period of dormancy, and when new insects are hatching out and entering on a period of activity, all intent on feeding and a consequent destruction of our crops. In the autumn months most of the insects are preparing for their dormant winter period, or at least a period of decreasing activity; accordingly insect damage from then onwards throughout the winter is on the wane.

The most important insects known to attack cane sets are the various species of cane grubs (*Scarabæidæ*), wireworms (*Elateridæ*), mole-crickets (*Gryllotalpa* sp.), plant-eating beetles (*Rhyparida* sp.), soldier fly larvæ (*Stratiomyidæ*), and others, each of which is known to do serious damage in certain areas. With this long region of foes arrayed against the grower at planting time, it would seem that his chances of obtaining a successful strike are somewhat meagre. Happily for him, some of these are so restricted in their choice of certain types of soils, moisture conditions, &c., and exhibit such partiality for certain plants which serve them as food, that seldom do more than one of these major pests occur in any one field

at the same time. Further, by taking pains in the preparation of his land previous to planting, and by cleaning up all waste and neglected areas, which form what one might almost term sanctuaries where pests may breed unmolested, he is ridding his farm of possible sources whence an insect attack may originate, and in so doing he is greatly increasing his chances of obtaining a regular stand of cane in his plant crop.

Notwithstanding, as previously pointed out, the number of pests that may beset the farmer at planting time, the writer is of the opinion that in many cases insect damage to newly planted sets is greatly exaggerated, and in the majority of cases so quoted, failure to secure a good strike is due chiefly to the lack of attention paid to the details of plant selection and to the actual cutting of the plants themselves. A case in point occurred quite recently when we were called on to investigate the failure of a certain field of cane, which the farmer wrongly attributed to insect attack. When this matter was investigated, it was found that the plants he had been using were from 2 to 4 inches in length showing one to two eyes only, which practice shows a lack of knowledge of the general principles of sugar-cane growing. The practice of planting three-eyed plants is now almost universally favoured, and plants should not be cut less than about 9 inches in length, despite the fact that more than three eyes may be included in this length of cane. In exceptional cases of canes with long internodes, two-eye plants may have to be used to enable the plant to pass through the planter chute, but such instances are comparatively rare. Obviously, in the case under consideration three-eyed plants should have been used, and if this had been done a high percentage strike would have been assured, for the forest land on which this failure happened, was, at the time of our investigations, carrying a fair moisture content. Small sets may strike and grow well in wet situations, but as soon as drought conditions prevail for any length of time the resulting plants are the first to wilt and die. Then, some insects such as our common brown ant (*Pheidole proxima* Mayr.) may take up their abode in these old dried-out cane sets, and are frequently credited with being the primary factors in the death of that set, whereas their presence there is chiefly secondary.

Again, the peculiar tendency which certain varieties have when grown under cold and wet conditions, of "bleeding" when cut early in the season, and later, failing to ratoon, has frequently earned evil reputations for many insects which happen to be present in that particular field. Such reputations are no doubt undeserved since they may or may not in any way be associated with sugar-cane as a source of food supply.

Fortunately, the cases cited above are not frequent, but are typical of a few that are met with from time to time. Information on subjects which involve such questions as cane cultivation can be readily obtained from the Field Assistant who pays periodical visits to the various sugar-growing centres.

GREEN MANURES FOR CANE CROPS.

By H. T. EASTERBY, Director of Sugar Experiment Stations.

THE practice of growing green crops, especially leguminous plants, is one that can be strongly advocated in cane cultivation. Canegrowers frequently ask for information as to the best seed to use, and the quantity per acre, and it is thought that a short article would be of assistance to growers.

Shortly summarised, green manures increase the warmth and better the texture of the soil, and such crops are generally looked upon as increasing the humus content. Other advantages are—

(1) During growth the ground is shaded and moisture is conserved.

(2) Erosion of fine earth is prevented during heavy rains.

(3) Weed killing is promoted.

(4) The deep tap roots of leguminous plants bring available plant food from the subsoil to the surface soil.

(5) The interposition of a crop other than cane acts in minimising diseases and insect attacks.

(6) Any form of crop rotation is an excellent one to practice.

Nitrogen is the soil element that becomes the most quickly exhausted, and is also the element that is the most expensive to purchase. Under favourable conditions the nodules upon the roots of leguminous crops contain countless thousands of

bacteria which seize the nitrogen from the air. It is possible to add from 100 to 200 lb. of nitrogen per acre.

The best forms of green manure to use for cane are cowpeas and Mauritius bean. These can generally be procured at any large seedsman's, but the price varies from year to year according to the supply. If there were a regular demand for green manure there is no doubt that farmers in the Southern part of the State would cater for the supply, but the demand is not nearly so great as it should be, and consequently farmers who grow this crop for seed are few and far between.

Green manure seed is generally sown broadcast at the rate of one bushel per acre. If it is drilled in, 20 lb. per acre are usually sufficient when the drills are spaced 18 inches to 2 feet apart. In Northern sugar areas it is generally sown broadcast, while in the South it is generally drilled. The best time to sow green manure seed is from October to the end of December—November is probably the best month. In sowing broadcast it is generally sufficient to harrow the seed in, but in any case the seed should not be planted more than an inch to a inch and a-half. It is a wise practice to sow after rain.

Cowpea usually flowers in from two to three months if conditions have been favourable, but Mauritius bean takes as long as five months, but usually makes a heavier crop. The best time to plough in green crops is at the time the seed in the pods is in a milky condition. Some difficulty may be experienced in ploughing in a heavy crop of green manure. but by first rolling, then disc harrowing, and finally using the plough with a large disc, it becomes an easy matter to cover the crop. Generally speaking, it takes from six to eight weeks for the crop to rot down. If this has taken place and the time is convenient, the ground can be got ready for the succeeding cane crop.

The following are analyses made of cowpea and Mauritius bean:—

Variety.	Pounds per Acre.			
	Nitrogen.	Phosphoric Acid.	Lime.	Potash.
Cowpea	151	35	..	96
Mauritius Bean	173	40	317	141

CANE GRUB ACTIVITY.

The Southern Assistant Entomologist (Mr. R. W. Mungomery) has furnished the following report for the period 15th September to 15th October, to the Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby:—

October is the month when grub damage in the South is likely to become very noticeable, and growers should keep a sharp watch for the first signs of their activities. The dry weather conditions which are now prevailing will help to reveal their presence, for it is well known that grubs have a greater effect on a cane stool during a dry period than during a wet period. Cane stools at which grubs are feeding are characterised by the outer leaves of individual sticks assuming a sickly yellowish appearance, while the central spindles, though green, show a decided wilt, which is unnatural with healthy growing cane. Bandicoot burrows around a stool of cane often furnish additional proof of grubs being present.

When the grower has satisfied himself that grubs are present, fumigation should be resorted to as soon as possible, and provided that the rooting system of the stool is not too badly damaged there is every reason to hope that it will recover sufficiently to produce a fair crop, but it is almost futile to wait until the young leaves are quite dry and the plant almost dead before fumigating, and then to expect a crop.

If grub damage shows up in the spring months, paradichlorobenzene can be used with good results. Care should be taken that this fumigant is not injected too deeply into the ground, otherwise it will not evaporate sufficiently to produce a high mortality, and 2-3 inches will prove a sufficient depth in the Bundaberg and Isis districts at which to bury these crystals. Paradichlor. has the property of giving

off toxic vapours for a considerable time, and this is a distinct advantage when we take into consideration the habits of our injurious scarabæid grubs. The majority of these grubs remain in the second stage throughout the winter months and assume their third stage in the spring. Soon after this last moult they usually rise towards the surface and recommence feeding at the cane roots. Now, as there is a marked overlapping of the second and third stages, it will be apparent that there may be differences as great as a month or more in the times at which different grubs resume feeding, hence paradichlor. is particularly suited to be used as a fumigant in such cases, for when each successive grub comes to feed at the stool and likewise comes within the effective radius, it is either killed or the fumigant may act as a repellant and drive it away.

Carbon Bisulphide as a Fumigant.

Carbon bisulphide, when injected in the soil, though quicker acting than paradichlor., and killing the grubs in a much shorter period, does not possess the property of remaining toxic over a number of days, and therefore would fail to kill those grubs which rise towards the surface subsequent to the act of fumigation. Later on in the year, towards December, when in the ordinary course of events thunderstorms have occurred from time to time and the soil is in a fairly moist condition, grubs for the most part will be found feeding near the surface (say within the first 8 inches of soil) and then the use of carbon bisulphide is to be recommended in preference to paradichlor. Used in sandy loam forest soil against third-stage "trichosterma" grubs last December, a mortality of almost 100 per cent. was obtained.

With paradichlor. injected at the same time, the difference was very apparent. Soon after applying the fumigants heavy rains were experienced and in a month's time no mortality had taken place amongst those grubs which were subjected to this latter fumigation, and the cane had suffered quite as much damage as that in the untreated rows. Later, however, after an interval of fine hot weather, the treated rows began to look very much greener, and healthy suckers came away from the stools. This plot then stood out in sharp contrast to the untreated rows which had been almost entirely killed. On closer investigation it was seen that the majority of the grubs had stopped feeding and were in a semi-paralysed condition. Succeeding rains accompanied by a reduction in temperature soon prevented further evaporation of the paradichlor. crystals, enabling the grubs to recover. They have since been watched with considerable interest, and recent diggings revealed the fact that they had pupated successfully. On account of this and similar past experience, the use of paradichlor. against large third-stage grubs is not advocated when the monsoonal season is imminent, carbon bisulphide being cheaper, easier to apply, and giving a higher mortality.

ENTOMOLOGICAL HINTS TO CANEGROWERS.

Exd.

By EDMUND JARVIS.

Weather.

Very dry conditions have been experienced during the last twelve months, dating from August, 1927, to July, 1928; the rainfall for which period has been 49.20 inches, or 42.24 inches less than the average annual precipitation for the district of Cairns; while the fall during June to October of last year (1927) happened to be 163 points less than the average for these five months of the year.

Don't Forget the Date on which Greybacks Appear on the Wing.

Growers would do well to make a note of the date on which these beetles are first noticed in canefields. Emergence of cockchafers from the ground usually takes place about twenty-four hours after a fall of from 3 to 4 inches of rain; such swarming serving to indicate that about six to eight weeks later is the best time for carrying out fumigation of grub-infested soil—viz., at a time when these larvæ, being in the first and second stages of growth, are not large enough to cause appreciable injury to the cane roots.

Capturing Greyback Cockchafers.

Preparations should now be made for collecting cane beetles on plantations where feeding-trees of *albohirtum* happen to be conveniently situated, and can be used as trap-trees.

The broad-leaved figs such as *Ficus pilosa* and *glomerata*, or the "Weeping fig," *F. benjamini*, are great favourites, and generally attract most of the beetles in the vicinity of a canefield. Where found growing close to headlands it would be a good plan on certain cane areas to cut out surrounding vegetation to within a radius of a couple of chains in order to induce beetles to concentrate upon them, and to facilitate collecting from same. During the first week from 20 to 30 per cent. of greybacks taken in this way will be females, but by the end of the second week after date of emergence the sexes are generally met with in about equal proportions, while during the third and fifth weeks after first appearance of the beetles about 75 per cent. of those collected will probably be females.

Remember that Both Sexes of the Greyback Cockchafer are Strongly Attracted by Artificial Lights.

It is necessary to again remind readers that the so-called "Southern Cane Beetle," *Pseudoholophylla furfuracea* Burm., is a totally different insect from the Greyback of Northern canefields. Mr. R. W. Mungomery, Assistant Entomologist, discovered that only about 1 per cent. of females of *furfuracea* are attracted by artificial lights; whereas, it has been conclusively demonstrated during the last fourteen years that both sexes of the greyback cockchafer are strongly attracted to acetylene and other artificial lights throughout their aerial existence. The proportions of female beetles captured in light-traps a few days after emergence from the ground varied from 20 to 25 per cent.; but about three weeks after emergence (early in January) catches during two consecutive evenings yielded 47 to 75 per cent. of the female beetles.

Emergence of Cane Beetles.

Greyback cockchafers commenced to appear on the wing around Gordonvale, Meringa, and Highleigh about the 6th November, when a few odd specimens were seen flying to artificial lights. The earliest emergence noticed by the writer at the Experiment Station was a female greyback which, on 4th November, was attracted from a weeping fig (*Ficus benjamini*) growing against a veranda. No decided flighting, however, took place until 15th November, so that by the time these notes are published this cane-beetle will have started to lay its eggs.

When to Fumigate.

The time to commence treatment of the first- and second-stage grubs of *Lepidoderma albohirtum* (greyback cockchafer) will date from about the third week in December, and continue until the end of January, as long as ground to be fumigated remains free from excessive moisture and the land continues unshaded during midday between the stools of cane.

The Farmers' Friends.

Do not destroy soil-frequenting larvæ which are predaceous or parasitic on cane-grubs.

Some of the commonest of these can be recognised by the following brief descriptions:—

1. White maggot-shaped sluggish larvæ about an inch long, which when ploughed up are often found attached to or alongside dead or paralysed cane-grubs.

2. Dark-brown elongate-oval cocoons from ¾ to 1½ inches long, composed of silk hardened to the stiffness of writing paper. These are sometimes exposed by the plough, and contain either male or female digger-wasp parasites.

3. Shining white maggots about 1½ inches in length, but more slender than those of No. 1, and able to move quickly through the soil by means of a pointed beak. These predaceous larvæ of "Robber Flies" pierce and suck the life juices from various cane-grubs.

4. Large flattened wire-worms, from one to two or more inches long, having yellowish-brown shining bodies with six small legs close to the head-end. These slippery, very active creatures are inveterate enemies of cane-grubs, seizing them with their sharp sickle-shaped jaws, cutting deeply into the body, and greedily imbibing the succulent contents.

What Causes "Dead-Hearts."

Growers should have a look occasionally at the condition of their young plant and ratoon cane, at a time when the shoots are from 9 to 18 inches high. Wilting or browning of the heart-leaves is usually due to the presence of some caterpillar

tunnelling in the centre of the stem. Although the "Large Moth-borer" is mainly responsible for such trouble, the larvæ of two smaller moth-borers and of a plant-eating beetle are also able to cause similar injury to the central leaves. All shoots affected by "dead-hearts" should be cut out, taking care to sever them at a point situated about 2 inches below ground level. These shoots should then be crushed or burnt to destroy any pupæ or caterpillars remaining in the tunnels. Infestations of less than about 10 per cent. do not as a rule necessitate control measures.

POSITION IN THE NORTHERN DISTRICTS.

The Entomologist at Meringa (Mr. E. Jarvis) has submitted to the Director, Mr. H. T. Easterby, the following reports on the Innisfail and Ingham districts by Messrs. J. H. Buzacott and W. A. McDougall:—

INNISFAIL.

This year the Innisfail Show comprised the finest collection of exhibits and events ever yet provided there. In combination with the South Johnstone Experiment Station and the Pathological Branch, a display from Meringa was presented, consisting of various insect pests of sugar-cane and their biological enemies, together with charts and wall cases depicting their life-histories.

The opportunity was taken to talk with the many farmers interested in the exhibit, and to endeavour to advise them, where possible, how to deal with some of the more important pests.

Grubs have been very bad this season throughout the district, though several farmers in the Goondi area fumigated their crop earlier in the season. Mr. MacLean, Field Officer at the Goondi mill, intends carrying out experiments on trapping beetles by light during beetle-flight. He also directed fumigation experiments on a few farms in the early part of the year.

Considering the late month of the year in which the show was held, the competitive cane exhibits were remarkably good, especially taking into account the fact that considerably more than half the cane in the district should be cut by now.

On farms served by the Goondi mill, a favourite green manure is the Rice Bean. This is a good cropper, and comparatively easy to plough in, and, although very subject to the attacks of insect pests, seems to do very well in that district. The Rice Bean is, undoubtedly, of high manurial value.

INGHAM.

From the 1st to 5th October was spent in the Victoria and Macknade mill areas. The district was dry and very dusty.

The Beetle Borer (*Rhabdocnemis obscurus* Boisd).

Throughout the mill areas the damage by this pest is less than 2 per cent. For the past two years tachinid flies (*Ceromasia sphenophori* Vill.) have not been liberated in these areas. During the five years previous to this, when the borer was a serious pest, 6,127 flies were distributed by officers of the Macknade mill; also several liberations were made by this Station. In the event of borer damage again becoming an economic problem in these areas, the facilities for its scientific control are in readiness at the Macknade mill. The fly cages have not been dismantled, and field officers are in touch with all farms throughout the districts.

The Pest Destruction Fund.

The mill areas are divided into ten districts (five in each area). The farmers in each district voluntarily strike levies, payable to a farmer secretary, for the destruction of the various cane pests, chief of which are rats and cane beetles (grubs and adults). This fund is independent of the mill managements, and is in the hands of the farmers themselves. According to the district the levy is struck on area under cane or on tonnage cut.

Grub Damage.

The greyback (*Lepidoderma albohirtum* Waterh.) has been responsible for considerably more than 90 per cent. of the grub damage in these areas. The last attack was very mild, only showing up on a few farms in the Hawkins Creek, Cordelia, and Stone River districts. The affected fields were cut early. In the

Macknade district, £177 1s. was paid in 1924-5 for grubs and beetles collected; in 1925-6 £127 9s. 7d.; and in 1928 £1 4s. 6d. In both mill areas, at present, the grub damage is negligible.

Damage by Rats.

It is to combat the rat trouble that most of the money of the various pest destruction funds is spent. The Macknade district pest destruction fund paid in 1926 £4 for poison; in 1928 £30 4s. 6d. for poison, and for labour for dropping baits £108 (approximately). At 6d. a rat, from 2nd July, 1928, £72 has been paid to collectors. The remaining districts are in a similar position with regard to rat damage, and, with the exception of one district which pays 3d. a rat, offer 6d. a rat to collectors.

Various poisons have been tried—viz., phosphorus and bread, strychnine and corn, arsenic baits, and the barium biscuit. At present the subject of rat poisons is in its experimental stage. The barium biscuit, for many reasons, would be the most suitable, but some farmers doubt its worth as an effective rat destroyer. It is thought that for rats the poison should be changed periodically.

Green Manures.

Last year 900 acres of green manure (chiefly Mauritius bean) were grown in Victoria mill area. In Macknade mill area 500 to 600 acres were planted last year, and approximately 1,000 acres (chiefly the two cowpeas and Mauritius bean) this year.

The Burning and Turning in of Trash.

If the field is to be ratooned the trash is burnt, but, before planting, more than 50 per cent. of farmers turn in the trash. As there is no borer problem to contend with, the mill authorities strongly recommend turning in of trash before planting. This practice is becoming more prevalent every year. By various analyses it has been proved that the turned-in trash is equal to one-to-two lots of green manure.

Cane Varieties Grown, and Gumming.

The following table gives the relative percentages of the different varieties planted in 1926 and 1927:—

Variety.	Macknade Mill Area.		Victoria Mill Area.	
	1926.	1927.	1926.	1927.
	Per cent.	Per cent.	Per cent.	Per cent.
Badila	22·0	24·2	32·4	31·8
H. 409	35·9	24·0	20·3	22·0
N.G. 24, N.G. 24A, N.G. 24B	5·6	3·9	9·6	7·1
Korpi	15·1	17·1	9·9	11·2
Nanemo	3·5	3·9	3·1	2·3
Oramboo	5·3	12·1	8·1	8·6
Q. 813	9·8	13·7	15·2	14·6
Innis	0·8	0·8	1·1	1·2
M. 1900 Seedling	..	..	..	0·1
H.Q. 426	..	..	..	0·2
7 R. 428 (Pompey)	0·3	..	0·1	..
Mixed (including D. 1135) ..	1·7	0·3	0·2	0·9

Before planting any varieties other than the first ten in above table, permits must be obtained from the mills. Mill officers see that clean plants are used for all planting throughout both mill areas. In 1926, 35.9 per cent. of the plant was H. 409. This dropped to 24.0 in 1927. At that time it was thought that this variety was too susceptible to gumming. Now, however, H. 409 is more extensively planted, as it was found that it is not so susceptible as it was first supposed to be.

H.Q. 426 is condemned on account of its extreme susceptibility to gumming, and the 0.2 per cent. planted in the Victoria area is for experimental purposes. It is under strict supervision.

Thanks are due to the chief field officer at the Macknade mill and the secretary of the Herbert River Farmers' League for information supplied.

BIOLOGICAL CONTROL OF CANE INSECTS.

Mr. E. Jarvis, Entomologist at Meringa, has submitted the following report for the period of September to October, 1928, to the Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby):—

Vegetable Parasite of Cane Borer.

About four months ago some test tubes containing cultures of a vegetable parasite known to attack a beetle borer (*Rhabdocnemis* sp.) found to affect sugar-cane in the Philippines were brought to this Experiment Station, instructions having been previously received from the director regarding the advisability of our studying its possibilities as a controlling factor against *Rhabdocnemis obscurus* Boisd. under North Queensland climatic conditions.

These cultures, which were prepared by Mr. A. F. Bell, Pathologist to the Sugar Bureau, in September, 1927, were grown on corn meal agar. During June of 1928 this fungus was successfully propagated on sterile slices of potato, and by the fifth day Mr. J. H. Buzacott, Assistant to Entomologist, who had been given charge of this work, noticed a growth of hyphæ, on which fructification appeared on the ninth day after inoculation; the average shade temperature during this period being about 66 degrees Fahr. Of the various methods of infection tried, that of spreading the spores on a piece of cane sectioned longitudinally and placing same with caged beetles was the only one that gave positive results. Other methods used were—

(2) Inoculating the beetles by a platinum wire;

(3) Placing them in a culture tube to crawl amongst the spores; and

(4) Sprinkling the beetles with water containing spores of the fungus.

Additional experiments carried out in September, 1928, demonstrated that this vegetable parasite will grow luxuriantly on sterilised rice; spores of the fungus being produced on this simple medium on the fifth day after inoculation.

Breeding and Distributing Parasites of the Weevil Borer.

The increase of *Rhabdocnemis obscurus* Boisd. having been favoured, as was expected, by conditions brought about by the last cyclone, special attention has been bestowed on the breeding of *Ceromasia sphenophori*, with the result that during the last few months (April to August, 1928) 1,127 living specimens of this tachinid fly were reared at Meringa Experiment Station and released on thirty-one different selections among borer-infested cane. In addition to these consignments, field boxes were established at Mourilyan and Mount Sophia, holding cane sticks containing in all about 150 puparia of *C. sphenophori*.

Liberations of live tachinids were made on mill areas of the following districts:—South Johnstone, 463 specimens; Goondi, 295; Babinda, 232; Mulgrave, 107; Mourilyan, 30.

The work of breeding and liberating consignments of this useful parasite has been given to Mr. W. A. McDougall, Assistant to Entomologist, who has shown much interest in this branch of biological control.

Entomological Exhibit at Innisfail.

Our Experiment Station was represented this year at the meeting of the Johnstone River Agricultural Society, held at Innisfail on the 5th and 6th October.

Despite industrial trouble on the waterfront, which prevented many growers from attending, the show at Innisfail this year was considered to be the best ever held in the district. The Station exhibit, under the charge of Mr. J. H. Buzacott, comprised showcases containing examples of North Queensland cane insects, amongst which were included the various life-cycle stages and insect enemies of primary cane pests such as *Lepidoderma albohirtum* Waterh. (greyback cockchafer); and the weevil borer of cane, *Rhabdocnemis obscurus* Boisd.

Other attractions were large diagrammatic coloured charts illustrating insect life, and a number of store boxes holding pinned specimens of many insects of decided economic importance.

Several growers availed themselves of the invitation to freely discuss matters relating to the control, &c., of insects which chanced to be troubling them, or to seek information regarding cane beetles and their grubs.

Review of Past Field Tests with the Grub Fumigant Paradichlorobenzene.

Between the dates 17th January, 1923, and 11th February, 1924, sixty-one experiment plots, of size varying from $\frac{1}{10}$ to $\frac{1}{4}$ acre, were laid down in various cane fields in the district of Cairns. Fumigation of the treated plots was made with a hand injector designed by the writer for this purpose; while the doses of paradichlorobenzene used varied from $\frac{1}{16}$ to $\frac{1}{4}$ oz. (apoth.), and in most cases were buried $4\frac{1}{2}$ inches deep, 12 to 18 inches apart, and 4 to 6 inches from the cane stools. Thus, the quantities used per acre varied from about 60 to 200 lb., which, however, comprised several brands, differing in price and quality.

Most of these plots were fumigated during the month of December, several in January and February, and a few in November.

The cane varieties treated were mostly D. 1135 and Badila, which had been planted during July, August, and January.

Sixteen field plots fumigated with paradichlorobenzene, but which were not grub infested, served to illustrate the fact that this chemical has no injurious effect whatsoever on the ultimate growth and development of the cane, seeing that the stools on all of these test plots were found at the end of the growing season to be equally as fine and healthy as those on a similar number of check plots alongside each of the fumigated areas.

On the other hand its effectiveness against cane grubs, when these were present, was amply demonstrated on plots at Woree, Meringa, and Highleigh (see Bulletin No. 19, pp. 39 to 47, Division of Entomology).

Success of Paradichlorobenzene in Russia against Scarabæid Grubs in Vineyards.

It will be of interest to mention that this fumigant has recently proved successful in Russia for destroying grubs of *Polyphylla fullo* L. a cockchafer which is very closely related to our own greyback cane beetle. The following extract from an article published in 1927 (Kiev. Nat. Commiss. Agriculture) gives a brief account of the method of applying this fumigant in Russia:—

"Paradichlorobenzene has proved effective for the control of *Polyphylla fullo* L. in the vineyards of the Lower Dnieper. Other larvæ occurring in the soil are also killed. It should be used at the time of planting out the young vines, which should be set at a distance of 21 inches, in rows 7 feet apart, and the fumigant should be placed in holes 21 inches apart, the lines of holes being also 24 inches apart. The paradichlorobenzene is applied at the rate of about $\frac{1}{4}$ oz. to each hole at a depth of about $3\frac{1}{2}$ to 4 inches and covered with soil. This applies to sandy soils; in heavier clay soils the dosage should be increased to about $\frac{1}{3}$ oz.

"Both larvæ and pupæ are killed by this treatment; oviposition seldom occurs in treated soil, and if eggs are laid the larvæ are killed soon after hatching. The effect of the fumigation lasts throughout the summer and does not injure the young plants."

Note.—The above recommendations as to weights of doses, distances apart, and depths of injections are practically the same as those which have long been recommended by our own Sugar Bureau for combating the grubs of a very similar species of cockchafer—viz., the notorious greyback beetle of our Northern canefields.

It is certainly very interesting to learn that the successful results now secured against *Polyphylla fullo* L. in Russia are practically the same as were obtained by us with paradichlorobenzene during the years 1923-24, which the reader will find reviewed under another heading in the present monthly report.

For the control of root-eating grubs in canefields, see full details given in the "Queensland Agricultural Journal," vol. xxix., pp. 97-113.

FIELD EXPERIMENTS AGAINST GRUB INFESTATION.

The Assistant Entomologist at Mackay (Mr. A. N. Burns) has submitted the following report for the month ended 12th November, 1928, to the Director of the Bureau of Sugar Experiment Stations (Mr. H. T. Easterby):—

Field Experiments against Grubs at West Plane Creek.

Continuing a series of experiments commenced by Mr. R. W. Mungomery in February last, in accordance with a request made by the Plane Creek Central Mill Company and some of the West Plane Creek growers, a grub survey was carried out in order to establish a suitable location for laying down several fumigation plots.

In the summer of 1927 practically all the farmers at West Plane Creek suffered severe loss of cane through grubs of the greyback cane beetle (*Lepidoderma albohirtum* Waterh.), and, in consequence, when the beetle emergence of the 1928 summer took place, hand collecting of beetles was largely resorted to, and the feeding trees in the immediate vicinities of canefields were in many cases destroyed. These factors, combined with the abnormally wet season, were most probably responsible for the marked decrease in grub infestation in this area this season. It was, therefore, fairly difficult to locate a site where conditions were most favourable for experimentation, the principal drawback for fumigation tests being that grubs were not present in large numbers. A spot was decided upon, however, and four plots (with controls) were put in. Results of these are summarised hereunder.

Paradichlorobenzene (Crude Quality).

This plot comprised seven rows each 1 chain long, fumigated with ½-oz. doses on either side of the cane stools. Doses were placed about 3 inches deep and from 3 to 4 inches away from the stools. A control block containing six rows of cane on the southern side of the treated plot was marked out. The final inspection of this plot (11th October, 1928) showed that the fumigated cane was erect and green and in every way superior to that in the control area, and more particularly when compared with the adjoining cane on the northern boundary, which presented a very withered appearance. This, as well as all the other plots, received 5½ inches of rain a few hours after injecting, so this may have had a slight influence on the results obtained.

See-Kay.

As the Plane Creek Central Mill Company had a sample of this material on hand, a request was made to fumigate a few stools with it whilst the other plots were being injected. Accordingly two rows, each 1 chain long, and adjoining the paradichlor. control plot boundary, one on either side, were injected with ½-oz. doses placed on either side of the cane stools, 3 inches deep, and about 3 inches from the cane plants. Considerable difficulties were experienced in injecting this plot, as the see-kay was very moist and sticky, and contained large masses of a gelatinous substance, which prevented free injection. A quantity of the freer material was separated and used, but this, however, still being sticky, gave much trouble in injecting. A final inspection (11th October, 1928) of this plot showed that the two treated rows of cane were considerably greener and better than the cane in the adjoining control blocks. The contrast, however, was not as marked as that obtained with the plot fumigated with paradichlor.

Carbon Bisulphide.

Five rows, each one chain long, and adjacent to one of the "See-Kay" rows on the southern side, were injected with ½-oz. doses of this fumigant. The doses were applied on either side of the cane stools, to a depth of 3 inches, and from 2½ to 3 inches away from the cane plants. At the final inspection of this plot (11th October, 1928) the results were somewhat disappointing. Very little difference was discernible between the fumigated cane and the cane in the adjoining control block. The cane was poor in both plots. In the case of this, and the following experiment, no doubt the precipitation of 5½ inches of rain a few hours after injecting would materially affect these plots; results should, however, have been better, as both plots were reinjected in fine weather some two weeks later.

Carbon Bisulphide and Paradichlorobenzene (Saturated Solution).

A request was made to treat a small area with a mixture of the above two fumigants, as good results had been reported at different times from their use in Northern canefields. A plot of five rows, each one chain long, was therefore fumigated with ½-oz. doses placed each side of the cane plants; 3 inches deep and from 2½ to

3 inches away from the cane plants. As stated above, owing to the very heavy rain that fell almost immediately following fumigation, this plot was reinjected some days later. The final examination of this plot (11th October, 1928) did not reveal as good a result as had been anticipated, the difference between the treated cane and the control area alongside being only slight. The adjoining cane on the southern boundary was decidedly more withered, but the comparison with the actual control block (which was on the northern side) was not so marked.

Emergence of Frenchi Beetles (*Lepidiota frenchi* Blkb.)

Following a fall of some 1¼ inches of rain spread over a period of three days (5th, 6th, and 7th instant) a small emergence of these beetles occurred at the Experiment Station and grass lands adjoining. The beetles commenced to leave the soil at dusk (about 6.50 p.m.) and continued to fly about for some twenty minutes or so, by which time most of them had mated and become quiescent. By 8 p.m. only isolated specimens were to be noted resting on cane plants, low bushes, &c. A large number of the beetles was collected, and it was interesting to note that these were all considerably undersized, and were paler in colour than is usual. They had evidently emerged from their cells before they had properly "hardened up" as their elytra and bodies were quite soft, and the white dusted scales on their bodies usually so noticeable in this species were only faintly visible. This may be confirmed by the results of observations made from specimens being bred in cages at the Laboratory, where the actual emergences from pupæ were about that time taking place. The examples, too, that emerged in this flight could only be those that had pupated close to the surface, as the rain had penetrated to a depth of only about 8 inches. The beetles being undersized is probably accountable from the fact that from last June up to the present fall of rain, the precipitation for these five months has been only 1.17 inches. Flying at the same time as the "frenchi" beetles were odd specimens of the Dasygnathus Beetle (*Dasygnathus australis dejeani* Boisd.), the Isodon Beetle (*Isodon puncticollis* Macleay), and a small species of Melolonthid, probably *Haplonycha* sp.

Occurrence of the Common Cane Skipper (*Telicota augias-kreffti* Macleay).

During the past few weeks the larvæ of this butterfly have been unusually plentiful in canefields on the leaves of young plant and ratoon cane. The writer has not before observed them in such numbers, and so widely distributed; in one instance no less than six larvæ were taken from one cane plant.

The eggs are deposited singly on the upper surface of cane leaves and shoots; they are of a yellowish pink (sometimes entirely yellowish) colour, slightly flattened at the top, and, if viewed through a lens, will be seen to be ribbed longitudinally. The period of incubation occupies from six to eight days. The young larva on emergence from the egg is creamy green with the head black. After the first moult, the head becomes brown, and the body pale green. The fully grown caterpillar measures approximately 1½ inches in length. Individual examples vary very considerably in the coloration of the head; it is usually pale yellowish brown or light brown without any markings. Some specimens, however, have black markings forming a triangle on the front of the face, and extending from the vertex to the mouth, sometimes enclosing a small brown spot just above the mouth. The apex of the triangle is situated at the vertex. One example was taken recently along with many others, which had the head entirely black. The body is always translucent apple green, sometimes slightly suffused yellowish. Occasionally specimens are met with having a small black spot on the anal plate, dorsally. Larvæ shelter within portion of a rolled leaf drawn together with threads.

The pupa is also enclosed in a rolled leaf; it usually measures about ¾-inch long, though many are less than that. It is pale brown in colour, with a raised black spot on either side of the dorsal area, just behind the head. The head bears a slightly raised rounded cap or operculum; cremaster slightly darker brown, prominent. Sometimes examples are seen in which the abdominal segments are suffused greenish, the green colour showing through the pupal skin from the internal tissues. This stage occupies slightly less than two weeks.

The adult butterfly measures about 1¾ inches across the expanded wings, and is coloured as follows:—

> Male (above).—Forewing brown-black, cell and base to sub-apical area, including three sub-apical spots; orange; distal area, composed of confluent spots, orange; cilia, brown black becoming orange towards lower angle. Sexmark prominent, dull black, edged black.

Hindwing brown-black, a large cellular spot and a broad irregular distal band, orange. Cilia, orange.

Beneath.—Forewing brown-black, apex and outer edge suffused orange brown, a large cellular spot and three spots near outer edge, orange yellow. Spots on upper side of wing faintly visible.

Hindwing orange brown, cellular spot and markings near outer edge as above, but paler and suffused brownish.

Female (above).—Forewing dark brown, a large cellular spot extending to beyond middle of wing, orange, three sub-apical spots, orange, a band of irregular orange spots near the outer edge. Cilia, brown-black, yellow near hind margin.

Hindwing dark brown, a small cellular spot, and distal band of confluent spots, orange. Cilia, orange.

Beneath.—Forewing as in male, markings near outer edge narrower. Hindwing as in male, markings near outer edges narrower.

This butterfly feeds naturally on blady grass (*Imperata arundinacea*) and has a very wide range, extending from Illawarra to Cape York. The true *Telicota augias* (Linn.) occurs in Java.

FIELD REPORTS.

Mr. J. C. Murray, Southern Field Officer, has submitted the following report for the period 12th September to 12th October to the Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby:—

GIVELDA.

The cane here looks well, but rain is needed to bring up the newly planted areas. Cane varieties growing are M. 1900 Seedling, Q. 813, H.Q. 285, Black Innis, and D. 1135. High c.c.s. values are being obtained for all of these.

In ratooning Q. 813 farmers are recommended not to use implements too vigorously and to be careful not to touch the stool. The root system of this variety is small and the stool is easily dislodged.

A considerable amount of fertilising has been done in this locality, the results indicating the value of potash. However, the growers have no really definite information as to which manure works the best, because so far they have carried out no local experiment. In regard to making a manurial experiment on his farm a grower would possibly reason as follows:—"I am not getting the tonnage I should get, yet the ground is well worked, the rain has fallen fairly regularly, and there is no serious disease. My soil must be getting short of plant food. When I come to think matters over, I have been on this farm for fifteen years and have put nothing back into it. It is obvious this is not a good state of affairs."

The farmers must then think of two things—what to apply and the method of application. The latter question requires careful consideration, as the practice of manuring has shown. There are three accepted methods—placing manure in the drills; drilling about a foot away from the cane when the plants or shoots are about six weeks old; and broadcasting on the interspaces. The latter method has a good deal to recommend it, as an even distribution of fertiliser is obtained over the field. Once a cane crop is well established the roots are taking tribute from every inch of soil. Experiments with manures should be combined with methods of application. Fertilisers that are a source of nitrogen (sulphate of ammonia and nitrate of soda) should not be applied unless conditions are moist. Farmers are recommended to green manure on the Givelda soils.

MULLET CREEK.

The cane in this locality appears to be good, although in some instances the c.c.s. values are not absolutely satisfactory. This applies more particularly to the E.K. 2 and D. 1135. Other varieties growing are B. 208, M. 1900 Seedling, H.Q. 285, and Q. 813; Q. 855 was also noticed coming to the siding. There is a considerable improvement noticeable in regard to transport facilities in the Mullet Creek area, the majority of the farmers now hauling with motor lorries.

The following recommendations are made to growers in the Mullet Creek district. Whatever cane the farmer decides to grow he should be very careful to get healthy plants. On the state of the set and the quality of the early cultivation depends very largely the success of the ratoon crop. Make the plant crop vigorous, and with few exceptions, good ratoons will be obtained.

Manuring, but only after local experiment, should be practised. Chance application of commercial fertilisers is not at all in the best interests of the growers of sugar-cane.

WALLAVILLE.

The cane on the line between Goondoom and Wallaville looks very healthy, but rain is wanted. Very fine cane of high sugar content can be grown on these dark soils. The railway is convenient for the farmers, the department having an excellent service with a siding every mile or so.

Cane varieties making a good showing here are M. 1900, Meerah, Q. 813, H.Q. 285. Unfortunately, Meerah is a variety susceptible to gumming disease, therefore the growers are advised to be cautious about planting it.

BAROLIN.

The soil in this area has retained its moisture splendidly in the face of a spell of very dry weather. Rarely can dry soil be found at a depth of eight inches. The cane is striking well and is healthy. If rain comes reasonably soon there should be a good summer showing of cane. The farmers are doing a certain amount of fertilisation, mainly bonemeal and potash.

Canegrowers often inquire as to the difference between steamed bone and raw bone. The following particulars will be of value to them:—

> Raw bone contains about 4 per cent. of nitrogen and 22 per cent. phosphoric acid, about 5 to 7 per cent. of which is soluble, the rest being insoluble. The phosphoric acid in raw bone is slowly available to plants, its usefulness extending over several years.
>
> Steamed bone has been so treated to free it from fat. Fat is more or less objectionable in a fertiliser. Steaming reduces the nitrogen in the bone so that it contains about 28 to 30 per cent. of phosphoric acid and about 1½ per cent. of nitrogen. About 6 to 9 per cent. of the phosphoric acid is available. Steamed bone can be ground much finer than raw bone and this greatly increases its value for immediate use.

Generally, the prospects are good. The standard of farming is high, although all interspace work is taking longer than it should—that is, if it is done thoroughly. Full width distributions for interspace manuring are also required. These should be simple and cheap. A hopper box supported by two sulky wheels with rakes behind will answer the purpose.

The small grower should be careful not to impose an undue burden on himself with machinery. Over capitalisation should be carefully avoided.

Mr. J. C. Murray, Southern Field Assistant, reports, 19th November, 1928:—

The spring has been dry, consequently the cane planted after the winter has been very slow in coming up. Notwithstanding this, the percentage of misses will not be high. All the mills have had to reduce their original estimates, but this has been compensated for by the high c.c.s. value of the cane. It is very much better to grow small crops of high sugar value than big crops low in c.c.s.

THE ISIS.

Autumn Plant.—Growing well, but affected by dry weather. Apparently free from serious percentage of disease infection.

Spring Plant.—Striking slowly and rain wanted. This has been a puzzling spring for the growers, the early part being much too cold to plant, and as the soil warmed the weather became increasingly dry. It is probable that the spring plant cane will be satisfactory.

Ratoons.—Ratoons this spring are very good. In most fields the shoots grew without any evidence of shyness. The most vigorous observed were the Black Innis

ratoons. This cane is coming into favour in this district. It is a variety that stools and ratoons with quick-growing qualities and a good sugar content.

Standover.—There was not much standover cane in the Isis area. It cut in good condition with a high average c.c.s.

Cane varieties looking well in the Isis district are:—N.G. 147 and N.G. 103 on Mr. Garnstrom's farm at South Isis, E.K. 28, M. 1900 Seedling, Black Innis, Q. 813, and H.Q. 285. As standover canes N.G. 16 and Badila are making a good showing. It is worth noting by cane-growers that Black Innis is thought to be identical with M. 189 (see "Varieties of Sugar Cane in Queensland," 1926, Bulletin No. 2 of the Bureau of Sugar Experiment Stations).

The two first named are making a good showing. N.G. 147 was introduced by the Bureau of Sugar Experiment Stations from New Guinea in 1912, as also was N.G. 103. Both these canes were again brought in from New Guinea in 1914 by the C.S.R. Company. Following are descriptions:—

N.G. 147.—Habit—erect; internode—barrel shaped; waxband—heavy; eye-groove—long and shallow; leaf-scar—prominent; eye—strong, medium-sized, well defined; trashes—freely; root system—light; colour—dark brown.

N.G. 103.—Colour—olive green, with light red to brown-coloured stripe; habit—erect; waxed—heavily; internodes—barrel shaped; eyes—medium and pointed; stooler and germinator—good.

Another variety that is making very good growth is E.K. 28. When thinking of cane varieties, farmers should remember that no man can speak with any authority unless he has had a cane under observation for at least six years. There is an inclination in recent years to make definite pronouncements prematurely regarding sugar-cane varieties—pronouncements perhaps on one season's observation. This is very foolish and misleading, as is amply shown when varietal resistance to disease is spoken of.

BOOYAL AND DALLARNIL.

Farmers in these areas are well satisfied with their crops from a c.c.s. point of view. The cane was light owing to the dry weather. No hitch has occurred throughout the crushing season. Regarding varieties and general agricultural conditions, there is nothing fresh to report since last visiting these places.

MARYBOROUGH.

Crushing here proceeded smoothly throughout the season, and farmers appear to have had satisfactory returns. The cane is ratooning very well. The plant cane is also satisfactory. The industry here is on a small scale, but is nevertheless in a promising position. Interest is now taken in better varieties, the wiping out of disease, and the use of fertilisers. There are still some cane varieties that should not be grown in the Maryborough district. When planting again, growers are requested not to grow Meerah, Rappoe, or Striped Singapore.

Some of the land requires draining. The best kind of drain on the river flats would be what is called a ditch drain. This should be about 2 feet deep and about 8 feet wide. All kinds of farm implements can pass over a drain of this description. It is the most serviceable wherever it will drain the land sufficiently. The grade of an open ditch must necessarily be low, otherwise the soil will wash. A fall of about 6 inches is enough. Curves should be very gradual, especially if the fall is greater than this. If a ditch of this description were running full after heavy rain, the water would be flowing at about 7 miles per hour. It is best, therefore, to build these ditch drains with a very gradual fall. Plant grass in them, if possible. It would appear that a drain of this type takes up a lot of land, but it should be remembered that badly drained land is the cause of heavy loss to Queensland farmers.

PIALBA.

At the time of visiting this district wagons and lorries were beginning to come in with a flag of green tops, indicating the last load. The season's operations have been smooth, no hitch occurring during the crushing. The weather has been very dry, nevertheless the ratoons are making an excellent showing. There should be a very good ratoon crop here next year. Regarding cane varieties, there is nothing fresh to comment upon since last visit. Probably the highest c.c.s. values were obtained from Q. 813.

The Northern Field Officer, Mr. A. P. Gibson, has submitted the following report on the important sugar-producing area of Innisfail, for the period 17th September to 19th October, to the Director of the Bureau of Sugar Experiment Stations, Mr. H. T. Easterby:—

Weather.

The weather for this period has been warm, dry, and dusty. Tanks are empty, wells are failing, water for domestic use is scarce, and is being carted, costing 8s. per 100 gallons, and there is much sickness. A good general rainfall is urgently required.

1928 Rainfall.

	Innisfail.	South Johnstone Sugar Experiment Station.	
January	15.45	11.12	
February	26.25	26.82	
March	34.50	30.72	
April	5.90	7.90	
May	9.07	8.68	
June	1.73	1.26	
July	5.15	5.11	
August	3.78	3.66	
September	0.02	0.12	
October (to 22nd)	0.08	0.00	(to 13th Oct.)
	101.93	95.39	

The Crop.

The district crop is composed mainly of Badila; this kind possesses the qualities of a good all-round cane on the better Northern lands. At the moment the crop is expected to yield about 42,000 tons more cane than that milled in the season 1927. Obviously, this tonnage would have been much greater had not cane grubs, weevil borers, and premature arrowing seriously affected its growth. The dry harvesting time has, however, permitted its quick removal, and at the same time proved favourable for its ripening. Sometimes crops experiencing abnormal growth, owing to drought or early tasseling, ripen speedily. When the ripening period is short, the cane becomes over-ripe and loses its sugar. Should nothing unforeseen happen, little, if any, of the 1928 crop will be left by the middle of December.

Mill Estimates.

	Cane Milled, 1927.	Cane Estimated, 1928.	Approximate Tonnage of Cane Crushed.	
	Tons.	Tons.		
South Johnstone	156,340	178,000	(to 13th Oct.)	128,000
Mourilyan	164,882	160,000	(to 13th Oct.)	100,000
Goondi	151,430	177,000	(to 29th Sept.)	119,000
	472,652	515,000		347,000

Cultivation.

The use of tractors, big and small, is ever increasing. They are foremost in hastening operations, and in cheapening most of the field work. They have taken the place of horses in hauling the loaded cane trucks from fields to permanent ways. Sometimes the field line is damaged, the result of a careless, inexperienced driver. Rotary hoes or cultivators are increasing in popularity; they may be attached to most modern wheel or caterpillar types of tractor. The chief uses are as follows:—

(*a*) Finely dividing exhausted cane stubbles, before ploughing;

(*b*) Tilling early the soil between the cane rows;

(*c*) Chopping trash to pieces, before it is ploughed in;

(*d*) Early weed destruction on headlands or resting fields;

(*e*) Shaving the surface of improperly harvested or high stools. This operation requires common sense, otherwise damage instead of good will result —the hoes should be kept reasonably sharp. Several farmers still toil with the old bow and arrow type of cultivation.

Pests and Diseases.

These are responsible for much deterioration or total crop destruction. The essential preliminary to the abolition of these is to outlaw them. They continue to spread, mainly, by indifference or ignorance. Cane grubs and the weevil borers in parts still are formidable pests. Rats, army caterpillars, and the larvæ of the big top moth and tineid moth borer also were noted. Leaf Scald is widespread and very severe in H.Q. 426 and Goru family of canes at Silkwood and El Arish.

Fertilising.

The quantity used is annually increasing. Different quantities, different manures, and different methods of distribution were noted. The time of application so that the crop derives the best results is ever a problem. Lack of moisture for the present may hinder the finer cane roots assimilating the fertilisers which are being added.

Green Manuring.

This is not grown to the extent that it deserves to be; the soil in this region—especially the porous red—seems to be lacking in organic matter. The growing of leguminous crops and the ploughing in of trash, where practicable, are highly desirable for its improvement.

MOURILYAN.

The management of this mill keep on trying to improve factory conditions.

Milling.

The variety almost entirely grown is Badila. The harvesting of some Pompey (7 R. 428) has been purposely delayed and an increased sugar content resulted. The factory is milling clean cane of high quality. Its crushing rate per hour and the mill efficiency are greater than ever before; 51.8 tons of cane are being crushed per hour, 7,002 tons of cane being the greatest amount treated in a 44-hour week. The mill average c.c.s. for the week ended 13th October was 15.92 per cent.; for the season to date, 14.14 per cent.; 7.23 tons of cane were wanted to make one ton of sugar. Only 0.8 per cent. of the crop has been fired before harvesting; this is most satisfactory. Work in the field is being hurried along; the weather being dry for so long there should be no excuse for grassy or poorly tilled crops. Pests, though severe in isolated parts, are fewer here than in neighbouring mill areas. Despite the long and prevailing dry weather the new crop looks wonderfully green; the curling of the leaf suggests that it is in serious need of moisture. Recently planted cane will suffer more than that planted and established; the dry hot soil will rob the plant of its moisture, when it will become weak, or completely perish.

SOUTH JOHNSTONE.

Much of the 1927 crop was late cut and was short of stem when it tasselled. This, and severe grub and weevil borer destruction, reduced the first estimate by fully 20,000 tons. There is much undulating, volcanic, red, rather porous soil in this area, and the planting of cover crops would improve its fertility and retard plant food leaching; this at the moment is just a patchwork of striking colours. The crop growing on high and low land is now showing signs of distress.

The main kinds of cane grown are Badila, H.Q. 426, and some Goru. The two last mentioned are much diseased in parts, and in some instances are grown on Badila land. The Goru family of canes should be entirely ruled out, and more attention should be paid to the selection of healthy and pest-free seed. If the farmers could be induced to pay more attention to this and refrain from using different varieties for filling the vacant spots in plant cane, the area of disease would be considerably lessened. Some cane ratooned poorly. The perishing canes are good breeding places for the borer, and, also, are likely to cause dry rot in the stool.

The mill has been working for some time now; it was not working full time when the area was inspected, owing, it was said, to some gangs refusing to harvest certain cane crops until fired. The greatest amount of cane treated in a 48-hour week was 7,329 tons, and in a 44-hour week, 6,890 tons.

EL ARISH.

Here the growers are returned soldiers; they produce about 30,000 tons of cane annually. The bulk of the harvested cane is sent to nearby railroad stations, whence it is derricked from small to big wagons and railed to the Tully for milling. The prevailing rainless weather has enabled the harvesting and cultural operations to proceed without interruption. Badila is mainly grown. H.Q. 426 and a lesser quantity

of other kinds were noted. Some cane stubbles have produced too long. Lack of money to clear the field of its encumbrances so as to permit the use of the plough has been the major reason for this. More land is being brought under the plough annually. In some instances the cost of production and work of the back-breaking type could be minimised by drawing the scattered field logs together, or, better still, right off the area, thus permitting the judicious and timely use of light interspace implements. Obviously much depends on proper plant selection. Farmers should exercise the greatest of care when selecting their seed. There is overmuch Leaf Scald in the area. H.Q. 426 is seriously troubled with this, and Badila is to a lesser degree. Two stools of Brown Rot were located; bananas, like cane, are also affected with this complaint when grown adjacent to certain kinds of stumps in new scrub land. Weevil borer damage was bad in parts. Larvæ of the big top moth borer and the tineid were noted. Rat injury was more severe along creeks.

Lime.—A small quantity of burnt coral has been used, and the result will be watched with interest.

GOONDI.

The bulk of the available cane to harvest has been cut. Operations in field and mill have proceeded smoothly and well since the beginning. Varieties grown are Badila in the good land and Pompey in the poor. The latter mentioned kind is being reduced as much as possible. Farmers here seem to realise more the great benefits to be gained by green manuring; many resting fields have been planted with Mauritius beans; this, like cane, requires rain. Greater efforts to improve the soil by trash conservation are conducted here; such a procedure is always considered good farming. In some quarters it is regarded as a medium through which some pests and fungi are carried over to subsequent crops, and therefore is better fired. Cane trash is treated in one of the many following ways:—

(*a*) Fired;

(*b*) Volunteered;

(*c*) Relieved; trash drawn off cane stools only;

(*d*) Rolling; trash removed to alternate drill and the bared interspaces tilled;

(*e*) Ploughing in of trash; best of all, but not practicable at all times.

When trash is left on the surface it decomposes or is weathered, so that the most valuable part of it is lost to the atmosphere.

Grub destruction was severe. This pest seriously undercuts the stubble foundation or rooting system, and the cane rapidly perishes. Early in October, farmers reported having seen some mealy back beetles on the wing.

BABINDA.

Mr. Gibson reports on the Babinda sugar-cane producing areas, inspected 23rd October to 3rd November, as follows:—

Weather and Rainfall.

Hot, sunny, rainless days, with moderately cool nights, were experienced during the month.

January	.. ..	13.20
February	.. ..	26.24
March	.. .. ..	44.28
April	.. .. ..	6.21
May	.. .. ..	11.06
June	.. .. ..	1.66
July	.. .. ..	5.96
August	.. .. ..	3.84
September	.. ..	0.10
October	.. ..	0.10
November	.. ..	0.34 (to 3rd)
		112.99 inches (to 3rd November).

It will be noted that very little rain has fallen during the last eight weeks, which is unusual for the locality, which is recognised as being the wettest in Queensland. This abnormal stretch of hot, dry weather parched the vegetation and diminished

the water in the creeks, but, providing it does not last too long, will be a blessing in disguise in so far as cane culture is concerned, for the following reasons:—

(*a*) It has maintained the crop sweetness and permitted it to be harvested in a quicker time;

(*b*) It has ameliorated the soil and improved its mechanical condition;

(*c*) It has enabled farmers to thoroughly till and suppress the weed growth. Furthermore, when rain does fall, the new crop being clean, well tilled, and still growing, must quickly cover the bare interspaces, thus reducing weeding and production costs.

Rising day and night temperatures, accompanied with different sky appearances at the end of October, heralded a weather change. Some rain of a patchy nature fell on the 1st instant; this, though small, will do good and has gladdened the hearts of the farmers.

Babinda is one of the most desirable cane-producing areas of the North, in that it has the soil, the rainfall, the climate, and the field problems are less numerous than those situated where the rainfall is insufficient; the most serious trouble due to excessive wetness is weed suppression and the difficulty in preparing the soil well before planting.

The Crop.

The crop consists mainly of Badila, some H.Q. 426, and a little Goru. At the outset this was forecasted to yield 190,000 tons, which is greater by some 12,000 tons than that milled the previous year, and the estimate still remains at that figure, although grubs, premature arrowing, and weevil borers more or less damaged or retarded the growth.

Harvesting and Milling.

The end of the season is in sight. Ideal conditions for the greater part have prevailed for harvesting. Severely grub-damaged crops were harvested early; the lighter crops now are being fired before cutting. Operations in field and mill have progressed smoothly and well; there has been an adequate supply of cane, and in consequence record weekly tonnages have been treated, which has enabled the factory to treat a greater tonnage in a shorter time. The general quality of the cane has been good; 157,000 tons have been milled to 3rd November, and it is expected the balance of about 33,000 tons will have passed between the crushers by 7th December.

Cultivation.

The long stretch of dry weather has permitted constant tilling, the area, generally speaking, is therefore cleaner and in a better order than previously. It is clear that the cleaner fields and their surroundings must, with the improved crop husbandry, result in an increased 1929 crop yield. The area on which the grub-destroyed cane was cut early was speedily ploughed and immediately replanted. Most of the plant cane was early planted, and its germination on the whole has been satisfactory.

Drainage.—Several growers have improved their canefields by draining.

Fertilisers.

Our canegrowers are beginning to realise the great value of fertilisers, and also the benefits to be gained by early application. To secure a well-balanced plant foot mixture and one suitable for different canes and soils is always a problem. Cane and soil analyses, together with carefully laid out field plots, should afford some interesting and valuable assistance. Sufficient moisture to act as a solvent is required, so that it may be early assimilated by the roots. Fertilisers should be applied within three months from planting or cutting; two dressings, though more costly, are often better than one.

Filter Press Cake.

The value of this spread over the less fruitful spots is not understood. It contains some lime and phosphates removed from the cane juices. Its scarcity, together with the cost of application and increased weed growth, are the main objections to its use. If weeds grow, so must the cane, and the faster it grows the sooner will it cover the interspaces. It is beneficial broadcasted over resting fields and mixed with the soil by subsequent cultivation. Increased plant germination and growth may be had by placing same in cane drill with seed. The use of too much must be guarded against.

Diseases and Pests.

Leaf Scald was very bad in Goru, bad in H.Q. 426, and was found in most Badila fields. The first-named cane has served its purpose in some placed and should now be eliminated. Weevil-borer destruction is too severe, and is increasing in spite of the fact that its parasite is widespread at present, and is abundant. Trashed cane is more affected than is untrashed. Numerous beetles and larvæ were found in some perished and dissected cane stools. The flies are reduced in number when all the cane is harvested, so it is late before they increase sufficiently to offer much resistance, therefore the breeding of one of our most dreaded cane pests is interrupted but little. Quarter-acre patches of borer-infected cane should be permitted to remain throughout the district, and if done should insure a larger supply of early flies.

WAUGH'S POCKET.

Most of the available cane for milling is harvested. The new crop, though possessing a good colour and making satisfactory progress generally, has not received any interspace cultivation, and in consequence the soil is now refractory. Leaf Scald and weevil borers have been noted, and the liberation of tachinid flies is recommended. Apparently there is much good soil in this district. The progress of this pocket is hindered owing to its not having a trafficable road.

Prospects for 1929 are promising at present for another good crop; but some rain is wanted to ensure its continuous growth.

TICK CLEANSING OPERATIONS.

Mr. W. Forgan Smith (Acting Premier and Minister for Agriculture and Stock) announced recently that tick cleansing operations were being carried out under a scheme in which the Commonwealth, New South Wales, and Queensland Governments were co-operating. Each of the Governments had appointed a representative to a committee that is known as the Cattle Tick Control Commission, and the first meeting of that Commission was held in March, 1927. This committee has been entrusted with the control of tick cleansing operations.

It was arranged that the tick cleansing operations would be commenced in New South Wales, the intention being that when that State is cleared of ticks, the work would be extended to Queensland.

Systematic attempts are now being made to eradicate the tick in the Northern Districts of New South Wales. The Minister stated further that the chairman of the Tick Commission, at a meeting held recently, mentioned that many stockowners were of the opinion that ticks were still being introduced into that State through tick-infested cattle in Queensland being allowed to run on country adjoining the New South Wales border, and the chairman suggested that a survey might be made of the country adjoining the New South Wales border for a distance of, say, five to ten miles, and particulars obtained as to the approximate number of cattle running on this area, in order that, at a later period, this portion might be dealt with. No action beyond that indicated above has been taken in this connection.

Immediately that the New South Wales territory is rendered free from ticks there will be full justification for Queensland to devote closer attention to the work of tick eradication within this State.

The Banana Weevil Borer in Java, with Notes on other Crop Pests.

By J. L. FROGGATT, B.Sc., Entomological Branch.*

I have to submit the following report of my visit to Java to study the position of the banana weevil borer (*Cosmopolites sordida* Chev.) and to search for and, as far as possible, study any parasites of or predators on that pest, and if practicable to forward supplies of such to Queensland.

The report has been written in two parts, the first dealing with the subject of the banana weevil borer, and the second treating of matters relating to sugar, tea, coffee, &c.

Leaving Brisbane on the 26th May, 1928, I arrived at Batavia on the 11th June. After arranging financial matters and presenting my credentials to the British Consulate, I left for Buitensorg the following morning, where I presented letters of introduction to the Director of the Department of Agriculture and Commerce, Dr. Barnard, to the Director of the Department Landbouw, Dr. den Berger, and to the Acting Director of the Institut voor Plantenziekten, Dr. van der Goot. At the Institut a room was very kindly given me and every facility offered for carrying out whatever investigations I wished to make. In reference to banana culture, &c., I was introduced to Heer Ochse, who extended me all facilities possible for obtaining the information desired, and also later made all necessary arrangements for supplying the bulbs of selected varieties of banana plants for introduction into Queensland.

After spending about a fortnight on investigational work in and around Buitenzorg, I arranged, with the advice and co-operation of Dr. den Berger, a trip through to Banjoewangi, calling at Bandoeng, Garoet, Pasrocan, Malang, and Djocja on my way. Through the courtesy of Dr. den Berger, the agricultural officers in each centre took me round their respective districts and supplied me with local information. Leaving Batavia on the 20th September, 1928, I returned to Brisbane on 4th October, 1928.

PART I.

The Banana Plant in Java.

Bananas were found to be grown in all campongs, agricultural settlements, throughout the districts visited during my trip through Java, the fruit constituting one of the important foods of the natives. In only one section of the island—namely, the Banjoewangi area—are bananas grown for export, and even there they are grown by the natives and supplied at a fixed price per bunch to the exporter at the wharf at Banjoewangi.

It is not the general practice to set aside definite sections of the campongs for the growing of this fruit alone, and cultivation such as is carried out in Queensland was not observed anywhere.

The banana plant appeared to grow to the best advantage in situations where the ground was sheltered from the full force of the heat of the sun. Wherever it was growing in exposed situations, both the growth of the plants and the bunches from them were less prolific than where they were more sheltered.

* This article comprises the major part of a memorandum prepared by Mr. Froggatt on his return from Java.—*E.V.*

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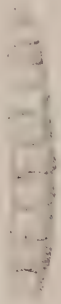

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PLATE 147.—PREDACEOUS ENEMIES OF THE BANANA WEEVIL BORER IN JAVA.

Chrysopila ferruginosa (Wied.).—1, Eggs, 15. 2, Larva, × 3. 3, Pupa, × 3. 4, Imago, × 3.

Plaesius javanus (Er.)—5, Eggs, × 2. 6, Larva, × 2. 7, Pupa, 2. 8, Adult, × 2.

Although a number of varieties of bananas are known in Java, there are relatively few that are held in general favour for consumption by the Europeans. I was informed that the list of known varieties does not apparently represent all that are grown by the natives, as others are being recorded from time to time.

The banana, being so universally grown for local consumption, calls for no special attention as long as the supplies are adequate for the demand. Furthermore, if a plant becomes sickly it is very readily replaced; all that is required is to dig a shallow hole, into which a medium-sized plant, dug from a nearby stool, is placed, and cover the bulb over with soil and ram it firm. On account of no detailed study having been made of this crop, I was unable to obtain definite information on the time taken from planting to bunching, and from bunching to the cutting of the fruit, although it would appear that the full period is less than twelve months. This would, of course, show a variation with the age of the plant selected for planting, this depending on the fancy of the native; apparently there is, however, a variation due to alterations in the climatic conditions at different altitudes. Neither were data available on the length of economic life of a stool.

After a plant bunches, the stalk is either cut off a foot or more above the ground and then cut across into two or three pieces, these being piled against the standing plants, or it is half cut through and left hanging. The subsequent decay of the plant tissue is very rapid, especially in the moister districts of the island.

The Banana Borers in Java.

There are two species of Curculionids breeding in banana plant material in Java, *Cosmopolites sordida* Chev. and *Sphenophorus planipennis* Gylh.

C. sordida breeds in the bulbs and cut stems, while *S. planipennis* apparently confines its activities to the stem tissue after the bunch has been cut or after the plant has died either as a result of attack by *C. sordida* or from other causes.

C. sordida apparently has similar, if not identical, habits to those recorded in Queensland. A very noticeable feature at Buitenzorg, where the climatic conditions were hot and humid, was the very slow rate of oviposition by this species. Very great difficulty was experienced in obtaining sufficient eggs for field testing for the presence of any possible egg parasites.

Sphenophorus planipennis oviposits in the ends of cut stems and in crushed portions giving an entry into the centre of the stem. The larvæ feed particularly in and immediately around the bunch stalk, and later spread through the tissue of the leaf bases. When full grown the larvæ form a relatively thick and tightly matted cocoon composed of the fibres of the leaf base tissue, pupation taking place after a period of quiescence (the prepupal period) inside the cocoon, which is usually embedded in the tissue of the leaf bases. The adult, after emergence, apparently lies comatose within the cocoon for a period before emerging into the rotten plant-tissue.

When newly emerged the beetle is a very light brown in colour with distinct black stripes along the thorax and elytra. The mature adult is a dull black.

S. planipennis is slightly larger than *C. sordida*, and is also much flatter on the dorsal surface, with the thorax showing two lines of

punctate markings. It is therefore readily distinguished in the beetle stage from *C. sordida*.

Field observations in the various districts went to show that up to approximately 1,000 feet altitude the activity of the borers, and especially of *C. sordida*, was comparatively slight, but at higher altitudes they were very much more active. This was most noticeable not only in the relative numbers of larvæ present in decaying stems but also in the relative amount of damage done. I was informed that this fact of the greater damage to banana plants by the borers at the higher levels had also been brought under the notice of the Institut voor Plantenzeikten at Buitenzorg. Furthermore, at Malang, as a result of questions put to the head of one of the campongs by Heer de Vries, we were informed that the destruction of banana plants was more pronounced during the wet monsoon than during the dry monsoon. The wet monsoon is reported to be the cooler part of the year in Java. In the campong referred to a plant was found that had been so badly attacked by borers that it had snapped off at ground level as the bunch was being thrown. This campong was at an altitude of about 1,500 feet.

From the general information obtained, partly by report and largely by my own observations, it would therefore appear probable that the hot climatic conditions existing on the lower levels exercise a certain retarding influence on the rate of breeding of *C. sordida* at any rate, since we know that in Queensland the breeding of this pest is very greatly reduced during the summer months.

Both *C. sordida* and *S. planipennis* were met with in all districts visited in Java, and apparently attacked all varieties of banana plants in any one locality to a relatively similar degree.

No egg parasites of either species were found, but the larvæ of the Leptid fly, *Chrysopila ferruginosa* Wied, and the larvæ and adults of the Histerid beetle, *Plasius javanus* Fr. were proved to be predaceous on the larvæ and pupæ of both species of the borers in captivity. This is dealt with later under the account of these predators.

No detailed investigations have been made into the subject of the banana weevil borers in Java, and consequently no information was available at the Institut on their life histories, habits, parasites, &c.; neither has any work been done on measures for the control of the pest.

Predators other than *P. javanus and C. ferruginosa.*

Possible predators other than *P. javanus* and *C. ferruginosa* on the borers are two species of Histeridæ, one or two species of Staphylinidæ, and two species of Hydrophyllidæ. These have not yet been specifically identified. Several species of Dermaptera ("earwigs") were fairly common in the rotting banana plant tissue, but no association was proved between them and the borer larvæ.

The smaller species of Histerid was fairly common in rotting banana material, and also in decaying sugar-palm and papaw stems. The larger species was received from the native collectors along with the adults of *P. javanus* and was collected in the rotting banana stems in the Buitenzorg area. This beetle was more active in its movements and took to flight more readily when disturbed than *P. javanus*, but in captivity was not nearly so voracious a feeder on borer larvæ as the latter species. No information could be ascertained on its life history, and the number received of the species in question was not sufficient to warrant its recommendation for closer study with the limited time available for the

general work. The other species of Coleoptera referred to above can, in the light of our present knowledge, be only considered as possible predators of relatively minor importance on the banana weevil borers.

With the exception of the larger species of Histerid, which was only taken in the Buitenzorg area, the other species referred to were found distributed throughout the districts visited.

Plaesius javanus.

In reference to the distribution of this species, no detailed information was available from the records of the Institut voor Plantenzeikten. I was informed that it was not known to occur in any of the outer possessions of the Dutch East Indies, but I found it to be generally distributed throughout those areas in Java which I visited. Owing to a combination of unavoidable circumstances, an examination in the jungle in East Java was not possible, but, in view of the fact that this predator is present all through the campongs in the surrounding areas, it is probable that it is also active in the jungle.

It may be stated that, except in the eastern part of the island, the jungle has been practically all cleared away to permit of the very intensive agricultural cultivation practised generally through Java.

Plæsius javanus was not present in the Buitenzorg area in very large numbers during the period over which collections for transportation to Brisbane were made. I was informed that at times it is, however, extremely numerous, thus pointing to a possible seasonal variation in its activities and numerical frequency. In the other districts visited, I found also that it was not as numerous as had been anticipated. The total number of beetles received from the native collectors was 5,757, with an average of 10·1 beetles per collector per day.

The adults (Plate 147, Fig. 8) were found in the tissue of rotten stems or bulbs, either standing in the stools or lying on the ground. The larvæ (Plate 147, Fig. 6) were more generally present in the rotting stems in which borer larvæ were, in most cases, active. Although not actually found devouring the borer larvæ or pupæ, they were often met with in such association with them as to definitely show that they had been actively predaceous immediately prior to being exposed. In captivity both adults and larvæ of *P. javanus* were extremely active in attacking the borer grubs. Neither stage, however, appeared to actively attack the adult weevils, although in one instance a newly emerged adult of *S. planipennis* was destroyed when enclosed in a petri dish with *P. javanus* adults for two days.

As there was no quick and ready means of distinguishing between the larvæ of *C. sordida* and *S. planipennis*, it was not possible to determine the relative degree of attack by the predator on these two species.

The egg (Plate 147, Fig. 5) of *P. javanus* was only collected on one occasion in a campong out from Solo, this being in a stem that had been half cut through and left hanging; in the crushed and decaying tissue where the cut had been made a single egg was found in close association with an adult of *P. javanus*.

A prepupa of *P. javanus* was collected on one occasion in a campong out from Malang in a semi-dry rotted stem. The larva had made a tangled mass of the fibres of the leaf bases, inside which it was lying dormant. In this instance the prepupal period lasted for seven days and the pupal period lasting from 2-3/8/28 until 17/8/28, the beetle being fully coloured by 21/8/28.

In captivity the adults of *P. javanus* were found to attack and completely devour the larvæ of the large Curculionid from palms (*Rhynchophorus ferrugineus* Olivier). This was rather remarkable, on account of the very great disparity in size between the beetle and grub. It may be stated that the beetle was sometimes dislodged at the first attack, but later was always able to obtain and maintain its hold.

In obtaining supplies of this predator for transportation to Queensland it was found impracticable to collect sufficient numbers of the predator myself. Consequently it was arranged, through the courtesy of the Acting Director of the Institut voor Plantenziekten, that the two senior native assistants should arrange for the collection by native boys while the sorting and packing was checked by myself. At first the price paid was 2½ cents (¼d.) per beetle, but it was found necessary to increase this to 3 cents, then to 3½ cents, and finally to 5 cents (1d.) per beetle, as the areas nearer at hand became effectively worked over. At the Institut the beetles were kept in tins containing damp moss, and in numbers not exceeding 300 per tin; weevil borer larvæ were placed in with them as supplies were brought in by the boys. During transportation from Java to Brisbane it was impossible to supply them with food, but the cases in which the tins were packed were carried, through the courtesy of the shipping companies (K.P.M. and Burns, Philp) and the ships' captains, as deck cargo, and were kept in as cool a situation as possible and stacked free from any risk of wetting by salt water. Under these conditions the rate of mortality was gratifyingly low in transit.

On arrival in Brisbane they were at first placed in damp moss in jars and fed on raw meat, on which they apparently feed fairly readily, and even more so after the meat had begun to putrefy. Portion of the beetles were later transferred to damp soil, and now all have been transferred to damp soil in tins. This was necessary, as the moss began to rot, and also became contaminated by the rotten meat which was dragged down by the beetles; furthermore, it was almost impossible to examine it satisfactorily for the presence of eggs. In an endeavour to supply them with insect food, Scarabæid larvæ have been obtained from Bundaberg through the courtesy of the Director of the Bureau of Sugar Experiment Stations, Mr. Easterby. These larvæ on being placed in the tins were readily attacked and completely devoured by the beetles. It is hoped that this food, more closely approximating to their natural food, may bring about the deposition of eggs, which, to date, has been known to take place in only a single instance.

The adults are highly predaceous on their larvæ in captivity, as also are the larvæ on one another, but it was not possible to determine to what extent this occurs in the field.

No parasites or predators on *P. javanus* were observed in Java, and none have been found to date on the beetles sent over. A series of dissections made of a small portion of these beetles failed to reveal any trace of any internal parasites.

The length of life of the larvæ is evidently very long. One larva that was not apparently very young when collected early in July pupated on the 12th November.

Owing to the difficulty of obtaining even sufficient food for the predators packed for shipment to Brisbane, the work of attempting to breed larvæ through at Buitenzorg had to be abandoned.

The adults evidently have a fairly long life; of the beetles collected over the period 25/7/28 to 17/8/28 there are a large number still alive and active. They will evidently live under fairly adverse conditions, as at Buitenzorg it was not possible to feed them to repletion, and then they were more than a fortnight without any food in transit. Furthermore, in Brisbane they have necessarily had to be fed on other than their natural food.

At present the rate of mortality of the *P. javanus* adults is very low, as also is the loss due to the exercise of predatory habits on one another.

Chrysopila ferruginosa.

No detailed information was available on this species at the Institut voor Plantenzeikten. I was informed, however, from another source that it had been collected in the Philippine Islands, Celebes, and Borneo, as well as Java. At the time of my visit the larvæ were very plentiful. In the wholesale collection of this predator, native collectors were also utilised, the price given per larva being first 5 cents (1d.), but when it was found to be so plentiful this was reduced to 3 cents; when the numbers received began to fall off early in September, the price was raised to 3½ cents each. The total number of larvæ received from the native collectors was 18,694, with an average of 11·5 larvæ per collector per day.

For transportation to Brisbane the larvæ (Plate 147, Fig. 2) were at first packed two or three together in small tins taken, and sent, over from Brisbane for the purpose, and containing damp moss with a little rotten banana plant material. When this supply of containers was exhausted, tins had to be bought locally; it may be stated that these were not the type which was considered to be the most suitable, but were the only type of small tin that was to be had. The most suitable type of tin was a small square or oblong one, the latter being not more than 2¼ x 3¼ x ⅞ inches in size; the lid must be very close-fitting and should not be hinged.

The larvæ were packed in these latter containers at the rate of six per tin in damp moss, together with a little rotten banana material. On arrival at Brisbane it was found that some larvæ during transit had crawled out of these tins into the boxes in which they were packed; when the counts were made it was found that some of the larvæ that had managed to work their way out of the tins in the upper layers had also managed to crawl into tins in the lower layers, as many as thirty-two having been counted from a single tin. This habit of leaving the containers in transit is rather remarkable, because such was not observed while the tins were stacked on my table at the Institut at Buitenzorg; although lying there for twelve to fourteen days only a very occasional larva was found to leave the tins in which they were placed. It could not have been due to overheating, at any rate in the second and third consignments, for the system of packing the tins allowed good ventilation.

During transit the degree of pupation was almost negligible, and the rate of mortality of the larvæ was fairly high.

After being unpacked in Brisbane the larvæ were, as far as possible, kept singly in small glass jars and examined periodically for pupæ. When the supply of small jars was exhausted they were kept in lots of five together in larger jars and transferred to the smaller jars in singles as the latter became available. Within a few days of arrival there was a further mortality amongst the larvæ, and also subsequently amongst the pupæ. In so far as the mortality in concerned, this must, to a certain

extent at least, be anticipated, as the transport of the developing stage of the insect, unavoidably without food, and in an unnatural habitat must lead to a serious derangement of the internal economy of the larva; furthermore, under the nature of the system of collecting that had to be adopted some of the larvæ would not be fully developed when sent away, and would naturally not withstand the rigours of transportation so well. Small colonies of the flies have been liberated in plantations in the Cooran district, where there is a considerable area under banana cultivation in contiguous plantations.

At Buitenzorg a number of pupæ collected in the field were kept under observation, and the flies on emerging were placed in a small breeding cage, together with sections of cut banana stem in different degrees of decay. Food was provided by soaking cotton wool in syrup and placing the wet material in a dish on the floor of the cage. The flies fed readily both on the syrup and on the juices of the rotting plant tissue. In the act of feeding, the legs are spread well out from the body, which is then lowered horizontally almost on to the feeding surface; the proboscis is then protruded.

Oviposition took place readily in captivity, but in no case, unfortunately, did the eggs mature. As mating was not observed, it is therefore possible that the eggs (Plate 147, Fig. 1) were infertile. For oviposition, a crevice, or borer hole, in slightly decaying stem tissue was selected; the ovipositor was extruded and curved forwards underneath the body, while the tip, projecting into the crevice, was moved about for deposition of eggs. The whole act was found to occupy about four to five minutes. The eggs were laid in an irregular mass, numbering generally about sixteen, although as many as fifty-nine were counted in one mass. After completion of oviposition, the tip of the ovipositor is apparently cleaned by the tarsi of the hind legs before being retracted.

In captivity, the wings of the flies quickly become broken, due largely to the strong flight of the adults, which dart to the sides of the container, against which they hit with considerable force. It is thus difficult to keep them in captivity for close study. In the cage they usually lived for about seven days.

In the field the larvæ and pupæ of this species were taken in rotten banana stem tissue generally, but not always, in association with borer grubs. In some instances very young, and even well developed, larvæ were found in such material in which there was little or no signs of borer activity, and in which no borer grubs or pupæ were present at the time of examination. There is no doubt but that the larvæ are predaceous, in very many instances at least, on both species of the banana borer grubs, but further study would be required to determine whether they can develop on a decaying plant diet alone, or are predaceous on other insect larvæ. In some instances it appeared at least possible that they were predaceous on Syrphid larvæ in rotten banana stems, and in one instance on Stratiomyid larvæ in a decaying papaw stem.

Owing to the difficulty of differentiating between the larvæ of the two species of banana weevil borers, it was not possible to determine the relative degree of attack on the grubs of the two species by the Leptid larvæ.

From pupæ collected in the field, a small Dipterous parasite (belonging to the family Phoridæ) was bred on six occasions, the larvæ emerging from the Leptid pupa about ten to eleven days after collection;

the pupal period was about seven days. This is apparently a pupal, and not a larval, parasite, as this small fly was not bred from any larvæ kept under observation. As the total number of pupæ under observation was 411, the percentage of parasitism (1·46) was very low.

Before pupating, the larva (Plate 147, Fig. 2) apparently has a short prepupal period; when the pupa is fully formed the larval skin is cast off over the anal end of the pupa.

The pupa (Plate 147, Fig. 3) is fairly mobile on account of the ready movement of the abdominal segments and the ring of chitinous spines arranged around each segment. This habit may be exercised in nature to enable the pupa when nearly mature to approach close to the surface in the rotten mushy material for the readier emergence of the adult. (Plate 147, Fig. 4.)

The following is a brief description of the life-cycle stages of this species:—

Egg.—Pearly white; length 1·5 mm.; breadth ·5 mm.

Larva.—Creamy white in colour; length about 30 mm.; width 3 mm. The most distinguishing feature of the larva is the elongation of the terminal anal segment of the body into four fleshy triangular-shaped lobes.

Pupa.—Reddish brown in colour; length about 25 mm.; breadth about 6 mm. Around anal segment are six spines, two ventral and other four more dorsal; around each segment is a row of small spines.

Adult.—Of a general brown colour with the tip of the abdomen much darker; the wings are well developed and are yellowish brown in colour and with one dark spot on the costal margin towards the apex. The sexes are readily distinguished by the shape of the abdomen, the males being much narrower in proportion to their length than the females.

Length of fly about 20 mm., width about 5 mm. over thorax, wing expanse about 40 mm.

It should be stated that in the notes made on the borers and the predators referred to, the observations can only be regarded as fragmentary on account of the limitation in time rendering impossible a complete study of the insects concerned; such would require at least many months of intensive study, both in the laboratory and in the field.

Pests Recorded from the Banana Plant or Fruit other than Weevil Borer.

The worst pest of the banana fruit in Java is the caterpillar of the fruit moth (*Notarcha octosema* Meyr.). This is present throughout the island and causes more or less severe blemishing of the fruit on practically every bunch. Experiments have been carried out for its control by blowing Pyrethrum powder up under the flower bracts of the young bunches, but owing to the very tall nature of the plants of many of their banana varieties, this is slow and costly. In reference to results from this treatment I was informed that, although promising, the trials would have to be repeated before any definite conclusions could be drawn.

Scirtothrips signipennis (Bagnall) was collected on the stems and bunches at Buitenzorg, and *Thrips partirufus* Gir. was taken in bud ends at Bandoeng and Buitenzorg. With more extensive collecting it is probable that both species would be found to have a general distribution through Java.

"Rust" (Thrips damage) was observed on a good deal of the banana fruit in Java, but was generally not severe. This is possibly largely due to the open nature of the hands of a large number of the varieties.

Erionata thrax (Hesperidæ) is fairly common, the larvæ rolling up sections of the leaf, inside which they develop.

The following insects were also recorded as banana foliage feeders:

Hispidæ.—*Gonophora riffa* (surface order), *Botryonopa sanguinea* Cuen (eats holes in leaves).

Scarabæidæ.—*Adoretus* sp., *Exopholis hypoleuca* Wlk.

Lepidoptera.—*Drapetodes mitaria* Gn., *Euproctis virguncula* Wlk., *Prodenia litura* F., *Ypilosoma strigtula* Wlk., *Mahasena hoching* Moore.

PART II.

Introduction.

In the general systems of insect pest control a great deal of attention is being paid to biological lines of attack and also to improved agricultural practice.

In crops such as tea, sugar, or coffee for example, the areas under crop are so large and the difficulty of proper supervision of native labour carrying out any treatment is so great that any chemical measures of attack on the problems are largely impracticable. This is not to say that such lines of investigation are not being tested out, for such is not the case; but it was evident that such measures could not be utilised on a large scale in many cases, at least, under existing conditions.

Owing to the very close attention that had to be paid to the main problem of the study of the position regarding the banana weevil borer and the search for parasites and predators, the amount of time available for following the other lines mentioned in my commission was very limited. As far as time permitted I visited the various Proefstations and met their technical workers, who were always most willing to show and explain their work to me; unfortunately the time that could be devoted to this work was all too limited.

The information given on the general crops was obtained largely by conversations with the different workers and also partly from the literature published on these subjects.

SUGAR-CANE.

The principal recorded pests of sugar-cane in Java are the stemborer, *Diatraea striatalis* Sn., the topborer, *Scirpophaga intacta* Sn., and the "White Louse," *Oregma lanigera* Zehnt. Of the last mentioned, a considerable amount of work has recently been done on the parasite of this species, *Encarsia flavo-scutellum* Zehnt.

Scarabæid larvæ are only bad in some fields, and these are usually poor soils; so far no measures have been attempted for their control. The worst species is *Holotrichia helleri* Brsk., which is a bad pest among many lowland crops; investigations have, however, only been recently begun into its life history, &c. Two species of Scoliid parasites, *Dielis*

thoracica Fab. and *Diclis annulata* Fab., are recorded on *H. helleri* (vide Bull. No. 13, 1915 Laboratorium voor Plantenzeikten, De Cassava—Oerets, S. Leefmans).

From inquiries made from Dr. Hazelhoff, Paserooan, and Dr. van der *Goot*, Buitenzorg, *Rhabdocnemis obscura* is apparently not known in Java.

It is possible that under certain conditions *Plœsius javanus* may, in Queensland, act as a predator on this Curculionid and may also act as a predator on Scarabæid larvæ in the soil. The Leptid, if it can be established in Queensland, may also act as a predator on *R. obscura*.

TEA.

There are a number of insect pests recorded from the tea plant; these are dealt with in Bull. IX. 1925, Mededeelingen van het Gouvernements Kina-Proefstation.

The tea Capsid (*Helopeltis antonii* Sign.) is the most serious pest of tea in Java. Dr. Menzel, the Entomologist to the Proefstation, has been devoting a considerable amount of study to the Braconid (*Euphorus helopeltidis* Ferriere), a parasite of the larva of this species. This Braconid is attacked by an Ichneumonid hyperparasite (*Stictopisthus javensis* Ferriere), thus rendering special precautions necessary in the field liberations of the parasite.

Investigations are also being made along the lines of improved agricultural practice to stimulate the growth of the plants.

H. antonii Sign. is reported to be worse in the region of Soeakaboemi than in the Preanger area (Bandeong, &c.).

COFFEE.

The worst insect pest of coffee is the berry borer (*Stephanoderes hampei* Ferr.). Hand picking of affected berries before the insects have reached full development and the use of parasites are the two lines of attack that are being worked on for the control of this pest.

The twig borer, *Xyleborus coffeæ*, also at times causes appreciable damage.

In the attempted control of the berry borer a considerable amount of work has been done with parasites imported from Uganda.

In the liberation of these parasites a node of the giant bamboo was taken and an auger hole bored through it in about the middle of the section. The parasited material was placed inside and the opening sealed with fine copper gauze. These containers were found to be very satisfactory for field use.

CASSAVA.

The main pest of cassava is the mite, *Tetranychus bimaculatus* Harv., which attacks the foliage. This does not, however, appear to seriously affect the growth of the plant.

There are a number of species of Scarabæid larvæ recorded as feeding on undersurface portions of the cassava plant. These are *Leucopholis rorida* Fabr., *Lepidiota stigma* Fab., *Euchlora viridis* Roufr., *E. nigra*

Fab., and *E. pulchripes* Lansb., *Anomala obsoleta* Blanch., *A. anchoralis* Lansb., *A. aerea* Perty ?, *Brahmina pumila* Sharp., *Lepadoretus compressus* Web., *Adoretus sciurinus* Burmeist, *Holotrichia helleri* Brsk., *H. leucopthalma* Wied., *Popillia biguttata* Wied., and *Serica* sp.

The Scoliid parasites recorded from these are *Dielis annulata* Fab., *D. luctuosa* Smith, *D. tristis* Sauss, *D. javana* Lep., *D. thoracica* Fab., *D. formosa* Guerin, *Triscolia rubiginosa* Fab., a species of Tiphia, and unknown species of Dielis.

MAIZE.

The leaf fungus (or lyer disease) *Sclerospora javanica* Palm. is the worst trouble experienced with maize in Java. *Heliothis obsoleta* occurs, but is not, so I was informed, a really serious pest of maize in Java. In a number of the islands of the outer possessions *Pyrausta salentialis* Snell is a serious pest of this crop, feeding in the upper portion of the stem, causing the death of the stalk, but it is not, so far, known to occur in Java.

FRUIT PESTS.

Citrus is subject to attack by several species of scale insects (Coccidæ), while fruit flies (Trypetidæ) also have caused considerable damage to the crops.

The following species of Trypetidæ are recorded from Java:—

Ceratitis capitata Wied., *Rioxa musæ* Froggatt—on citrus.

Bactrocera curcurbitæ Coq.—on melons, &c.

Bactrocera ferruginea Fabr.—on mango, *Capsicum annuum.*

Bactrocera caudata Fabr.

Dacus garciniæ Bezzi.—on *Garcinia dulcis.*

Dacus umbrosus T.—in large fruit such as the "Jack Fruit" (*Artocarpus integrifolia*).

A good deal of success was reported against *C. capitata* by the use of poison syrup baits hung in the trees. The baits comprised sodium arsenite, lemon juice, molasses, and a little sugar.

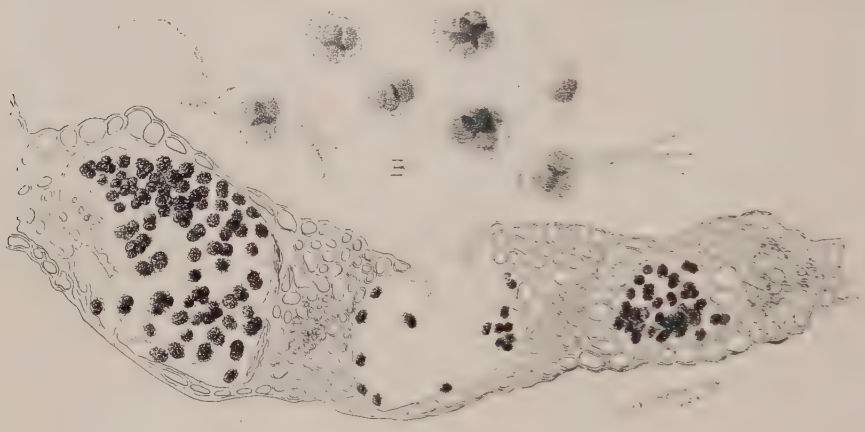
Citrus is subject also to "Collar Rot," special investigations into which are now being undertaken in the Citrus Experimental Garden out from Malang.

In conclusion, I wish to express my indebtedness to Dr. Barnard, Director of the Department of Agriculture and Commerce, Dr. den Berger, Director of Agriculture, Dr. van der Goot, Acting Director, and Dr. van Karlshoven, Institut voor Plantenziekten, and Heer Oehse, Department Land bouw Buitenzorg, for their ready assistance to me in obtaining information and furthering the objects of my mission in every way possible, and to the Landbouw Consulents, Heer Koorenhof at Bandoeng, Götz ven der Vet at Solo, and Dr. Loos at Bandowosa, and Heer Woolf at Garoet, the Tuinbouw Consulent, Heer de Vries at Malang, for their assistance in showing me round their districts, and for the information so readily given, and to Dr. Hazelhoff, Dr. Mensel, and the other technical workers for their courtesy in showing and so fully explaining their work to me.

Flag Smut of Wheat.

By J. H. SIMMONDS, M.Sc., Plant Pathologist.

Serious loss to wheat from disease is fortunately not of frequent occurrence in Queensland. During the past season, however, a malady commonly known as Flag Smut has been found to be present which may account for considerable reduction in yield if precautions are not taken to minimise this loss. Flag Smut is a fungus disease caused by the organism known scientificially as *Urocystis tritici*. Although this disease has been present in Australia since 1868, there have previously been only two isolated records of its occurrence in this State, in the years 1906 and 1915.



A

Plate 148.

A field survey made by officers of the Agricultural Branch since the first discovery of Flat Smut this season has shown the disease to be fairly widely distributed throughout the chief wheatgrowing districts. It is probable that in some of the affected areas the disease was present the previous season, if not earlier, but not in sufficient quantity to come under notice.

In most crops examined the number of affected plants was small, and the loss would be slight; but in some fields, which may have borne infected crops the previous season, a loss of up to 20 per cent. had occurred. In Southern States, loss from Flag Smut is reported to vary from 5 to 70 per cent. of the crop.

In order that growers may recognise Flag Smut, and take what precautionary measures are possible for overcoming this disease, a description of the characteristic symptoms and a summary of the principal control measures are given below.

Symptoms.

The first definite symptoms of Flag Smut appear as narrow greyish lines running up the leaf parallel with the veins. The lines are continuous or more or less interrupted. The streaking may be so closely

Plate 149.

formed as to give a characteristic leaden colour to the whole leaf. (Plate 150, Fig. B.) The region of the grey streaks is usually slightly raised above the general level of the leaf, and in later stages may sometimes become ruptured along its length to expose a black sooty mass of fungus spores.

The presence of the fungus within its tissue usually stimulates the wheat plant to abnormal growth, with the result that the flag becomes twisted and wound about itself in a very characteristic manner. (Plate 151.)

A plant affected with Flag Smut remains stunted and deformed, and is usually unable to develop ears. In some cases it may be found that one or two stalks of a stool have produced normal ears, while the

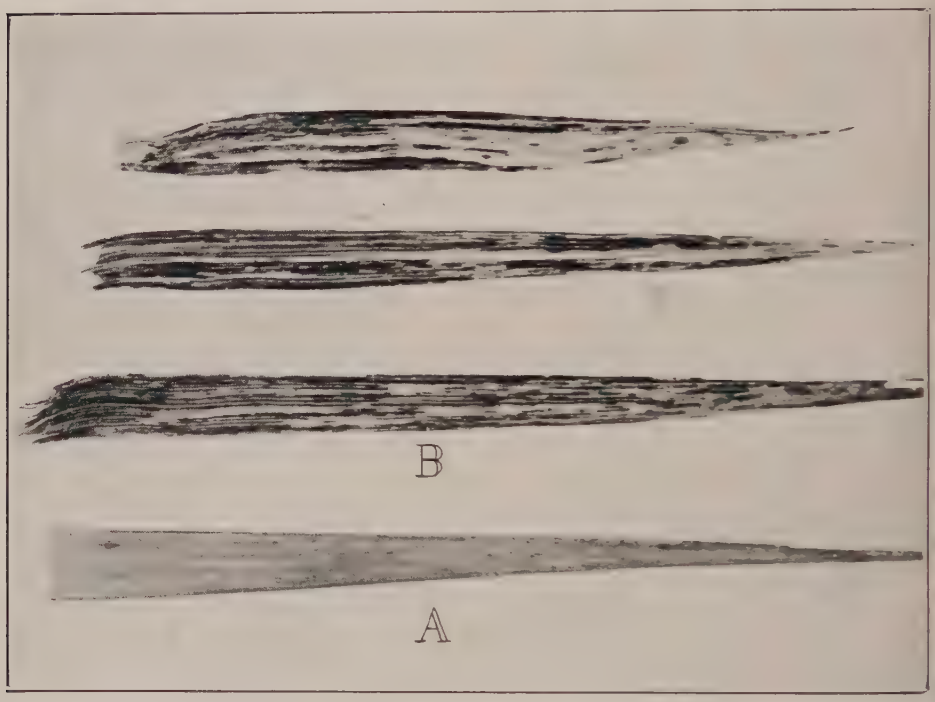


Plate 150.

rest exhibit the stunted, diseased condition. Sometimes an empty and malformed head may be seen caught up in the twisted flag, or it may be free from this, but bearing, if any, only shrivelled grain.

The small, stunted or abnormal plants are not particularly conspicuous, and for this reason Flag Smut often may not be given its due place as a factor in producing a light yield. The quality of the grain that is actually harvested from a crop in which Flag Smut occurs is unaffected by the presence of the disease.

Cause.

Flag Smut is caused by a fungus (*Urocystis tritici*) allied to those other fungi responsible for smut diseases, such as, for example, Bunt and Loose Smut. This organism can readily be distinguished from the causal

Plate 151

fungus of the other wheat smuts by the characteristic appearance of its spores. These are minute rounded to oval dark brown bodies, and are surrounded by a layer of sterile bladder-like cells which are not found in connection with the spores of either Bunt and Loose Smut. (Plate 148.) It is these dark spores present in enormous numbers which produce the leaden-coloured streaks in an infected flag. They may lie singly, but are more commonly associated two to four together to form a cluster known as a spore ball.

During the ordinary routine of harvesting and cultivation the spores are liberated into the soil, or may contaminate the seed in the harvesting and threshing machinery. These spores when conditions are suitable will germinate by putting forth a short filament which typically branches to form two or three secondary spores. (Plate 148.) These sporidia, as they are called, may then produce a delicate thread-like germ tube which is able to penetrate the wheat plant when this is in the tender condition of the germination period before the shoots are above ground. The delicate colourless threads of the fungus then grow up through the tissue of the plant as this develops, and finally at the points represented by the grey lines develop from its branches the innumerable dark-brown spores mentioned above.

Control.

A consideration of the life history of the Flag Smut fungus has shown that the wheat plant may be infected by spores which are contaminating the seed or by those already in the field, which have been derived from portions of flag-smutted plants left from a previous crop, or which have been introduced mechanically by the wind or on the person of men and animals. Seed contamination is the least serious, as the danger of Flag Smut arising by this means may be largely overcome by the ordinary methods of seed treatment. To free the land from infectious material is a rather more difficult undertaking, and to do so without causing some inconvenience is hardly possible. The following recommendations are designed to minimise the loss from Flag Smut:—

(1) Treat the seed with fungicides as for the control of Bunt. This procedure is imperative if the fields to be planted are still clean. If the field is badly contaminated with diseased material from a previous crop full benefit may not be obtained from the seed treatment—though this is still desirable—as infection may take place from spores in the soil. The standard methods of pickling can be followed.

For dry pickling, copper carbonate is used at the rate of 2 oz. to the bushel. This is applied by revolving the seed with the powder for several minutes in a box or other container in order to ensure thorough and intimate mixing so that each individual grain is completely enveloped in the fine dust. Where a gravity pickling machine is used the grain should be passed through at least twice. The less effective method of turning the seed over on the floor should be avoided. The dry process has the advantage in that germination is not impaired and the seed may be treated some time prior to planting.

The wet method consists of immersing the seed for two or three minutes in a solution of bluestone made up at the rate of 1½ lb. to 10 gallons of water. The seed is stirred in order that thorough wetting may take place and any bunt balls may rise to the surface and be

skimmed off. Only wooden or copper vessels can be used to contain bluestone solutions as this chemical will eat through iron. A somewhat inferior method sometimes employed consists in sprinkling the seed with the solution and turning it over until all the grains are thoroughly wetted. After treatment the seed is dried and then sown as soon as possible. If germination is delayed some injury to the grain may result from the use of bluestone, and when the seed is to be sown in a dry seed-bed it may be advisable, after treatment with the bluestone, to dip it for a minute or two in lime water prepared by dissolving 1 lb. of burnt lime in 10 gallons of water by which means the chance of reduction in germination is minimised.

(2) Whenever possible burn all stubble and straw as soon as harvesting is completed, as by so doing a large proportion of the spore-bearing material may be destroyed. Then fallow the land since the working of it will help to induce spore germination leading to death of the fungus in the absence of its host plant.

(3) A field that has borne an infected crop should be rotated for two years to crops other than wheat in order that the fungus may have time to die out of the soil. As the organism causing flag smut can infect wheat only, any other crop may be planted during this interval. The more cultivation the field receives during this time the better.

It is a wise plan to practise a certain amount of rotation even in fields in which Flag Smut has not been observed, since a slight infection may often occur which is easily missed during casual inspections. This may lead to successively heavier infections if wheat follows wheat every year.

(4) Avoid feeding stock on diseased hay and stubble as the spores of the fungus are able to pass through the animal uninjured and thus the disease becomes further distributed in the manure. Mechanical distribution on the feet of field workers and animals is always liable to occur and should be avoided as far as possible. Harvesting of badly affected fields should not take place during windy weather. Harvesting machinery after being used in a diseased field should be cleaned as thoroughly as possible before being taken into an uninfected field.

(5) Plant in a moist well-cultivated seed-bed as the chances are that many of the spores will by then have germinated and died. Avoid planting in a dry seed-bed, as spores and wheat then tend to germinate at the same time and infection is likely to result.

(6) Varieties of wheat differ in their relative susceptibility to Flag Smut. In an infected district it is therefore advisable to avoid planting varieties subject to the disease. Little definite information is available at present so far as Queensland is concerned, but it would appear that "Canberra" is definitely susceptible here as in other States, and the use of this variety wherever Flag Smut is prevalent should be discontinued.*

Other Wheat Smuts.

It has been found that there is a certain confusion in the minds of some growers regarding the identity of the different smuts affecting wheat. Typical illustrations of Bunt and Loose Smut are therefore given in Plate 149 for comparison with Flag Smut.

* It is hoped next season to conduct a test of the relative susceptibility of all the varieties commonly grown in Queensland.

Bunt or Stinking Smut shows up in the mature ear when in place of the normal grain there is formed merely a shell filled with a black evil-smelling mass of fungus spores (Plate 149, Fig. B). This compact mass of spores is known as a bunt ball. When these are crushed so as to liberate the spores on to seed wheat, infection of the germinated seedling may take place as in the case of Flag Smut. Bunt may be readily controlled by the seed treatment mentioned above, since contaminated soil is not the frequent source of infection as it is in the smut disease just described.

Loose or Flying Smut, like Bunt, affects the ear, but in this case shows up at flowering time. The fungus forms a sooty mass of spores in the ovary and other floral organs and no grain is formed (Plate 149, Fig. A). The spores are readily blown away by the wind, and if they should lodge on a healthy flower head they are liable to germinate there and penetrate the developing ovary. The fungus then remains within the grain in a dormant condition until the seed is planted, when it commences to grow up within the developing wheat plant and finally forms its spores in the flower head.

Since the fungus is present, well protected within the tissues of the grain, the seed treatment used for Bunt and Flag Smut is ineffective in the case of Loose Smut. To reduce the loss from the latter disease it is therefore necessary to obtain seed from a crop in which Loose Smut is not present, or else use a hot water treatment in which the temperature is such that the fungus is killed but the wheat itself remains uninjured. This latter procedure is, however, somewhat troublesome for the average grower to adopt. Jensen's modified hot water treatment consists in presoaking the seed for about five hours in tepid water, when it is then immersed for ten minutes in hot water held at 129 deg. Fahr. (54 deg. C.). The temperature of the water during this process should not vary above 131 deg. Fahr. or below 124 deg. Fahr., but should be kept as near as possible to 129 deg. Fahr. by the addition of hot or cold water. At the upper limit the grain may be injured while at the lower the fungus is not killed.

CONTROL OF FLAG SMUT IN WHEAT.

Flag Smut is caused by a fungus which attacks the wheat plant at the time of germination and then grows through the tissue as the plant develops, causing a deformity and stunting of the flag, so that a normal ear rarely develops. A diseased plant may be readily picked out by the appearance of the flag, which is variously contorted by twisting about itself, and exhibits streaks of a grey or leaden colour running up its length. These streaks are due to the production of innumerable fungus spores within the tissue.

The Minister for Agriculture expressed concern at the prevalence of this disease in the wheat crops harvested on the Darling Downs this season. The situation called for immediate action on the part of the growers concerned, and to assist them the Minister made available the following recommendations for the control of this serious disease. These recommendations have been drawn up by the Plant Pathologist of the Department (Mr. Simmonds) and are those generally believed to be effective for the control of this disease provided they are enthusiastically adopted by the growers as a whole. The Minister, however, stressed the necessity for enthusiastic action on the part of the growers, for the success of any campaign rests very largely in their hands.

The following measures should be adopted by growers whose farms are at present free from infection:—

(1) Obtain seed from a district where flag smut is not known to exist, and as an additional precautionary measure treat the seed with a fungicide as for Bunt.

(2) Practise a rotation to other crops after wheat for at least one year in order to give a better chance for the fungus to die out of the soil should an infection have occurred too slight to be noticed.

Where infection has already been established the action to be taken is as follows:—

(1) Burn all stubble and straw as soon as possible after harvesting is completed, and then fallow the land as the working of it will help to induce spore germination, leading to death of the fungus as no suitable host is available.

(2) Avoid feeding stock on diseased hay or stubble, as the spores may pass through the animal uninjured and thus become further distributed in the manure. Mechanical distribution on the feet, &c., of field workers and animals is always liable to occur, and should be avoided as far as possible.

(3) Rotate an infected field for two years to crops other than wheat. The more cultivation the field receives during this period the better.

(4) Disinfect all seed used with the copper carbonate or bluestone and lime treatment, as recommended for the control of Bunt.

(5) Plant late and in a moist seed bed as the chances are that many spores will by then have germinated and died out. Avoid planting in a dry-seed bed, as spores and wheat then germinate at the same time and infection is likely to result.

(6) Distribution of flag smut by use of harvesting machinery which has previously been used on a diseased crop is a danger which should be avoided as far as possible.

Certain varieties of wheat have shown decided susceptibility to flag smut in other States of the Commonwealth. Should some of the Queensland grown varieties be proved susceptible to this disease, their use in districts where flag smut is prevalent should be avoided.

A NEW I.M.S. CHAMPION.

"Evelyn of Sunnyview," 9412, Vol. 2 I.M.S., has gained the title of Australian I.M.S. champion junior two-year-old.

She commenced her test at two years and three and a-quarter months of age and produced 19,429.68 lb. of milk containing 567.624 lb. of fat in 273 days, exceeding the record made by "Gentle 6th of Greyleigh," the former champion, by 76.06 lb. of fat.

That "Evelyn" combines the type and character of her breed is evidenced by her successful career in the show rings, securing her first blue when barely seven months old in the class for heifers under twelve months. This success was followed up by gaining blues at Kingaroy, Murgon, Kilkivan, Maryborough, Gin Gin, Bundaberg, Rockhampton, and Gympie, and fourth in Brisbane Royal, in class under twelve months.

In class one year and under two years she continued her success by winning blues at Kingaroy, Wondai, Murgon, Maryborough, Childers, and second at Gin Gin, Bundaberg, and Gympie. She also gained champion honours at two and reserve champion at three shows.

In class sire and progeny she was one of a group that was placed first twelve times, and in class for pen of dairy heifers was placed first nine times.

Show ring honours were added to by her securing four first prizes in milking competitions.

The new champion is by "Diamond of Greyleigh" 297, I.M.S., who is a grandson of "Fussy's Pride of Hillview," 302, I.D.C., N.S.W., being by "Foch of Greyleigh," 33, I.M.S.H.B.

Her dam is "Snowdrop of Sunnyview," 4219, I.M.S.H.B., by "Young Victor."

"Evelyn" was bred by and is the property of Mr. Joseph Phillips, Sunnyview, I.M.S. Stud Farm, Wondai.

LESSONS ON POULTRY FOR JUVENILE CLUBS.

These lessons, which will be issued in three sections, have been designed to meet the requirements of Juvenile Poultry Clubs.

Section 1 has been prepared with the object of covering the first section of Juvenile Club work, which embraces the care of pullets.

Section 2 will deal with the care of laying stock, which is the second phase of Club work.

Section 3 will embrace breeding, the third and final stage of Juvenile Club work.

The scheme of Poultry Club organisation provides for Juvenile, Senior, and Adult Clubs.

A further series will be prepared for Senior and Adult Club work.

Lesson I.

HOUSING.

To obtain the best results from poultry, good housing is as necessary as good stock, good feeding, and good management.

Essentials.—Correct ventilation, freedom from draughts, freedom from moisture; sufficient room for the comfort of the birds.

Design.—Poultry houses may be built of a variety of shapes, but they should always be open-fronted. They should be constructed so that a space of 3 inches is left between the top of the back wall and roof, to provide for ventilation.

In building a new house the following photograph should be closely followed in design.

Site.—Poultry houses should be built on well-drained land. Positions with gentle slopes to the north and north-east are ideal. Wet and damp houses are cold and unhealthy.

Material.—Timber, free from cracks and crevices, and galvanised iron are most suited for building poultry houses. The walls may be made of galvanised corrugated iron, kerosene tins, timber, or sacks whitewashed. The roof should always be iron and, as cracks and crevices harbour vermin, iron is most suitable for the whole structure.

Size.—Where a netted run is attached to a poultry house, 2 square feet of floor space per bird should be allowed. As Club members only have a few birds, large buildings are not necessary.

A house 4 feet by 4 feet will accommodate six hens and a rooster. The house should be 4 feet high at back and 4 feet 6 inches high in front.

A lower roof would make the house too hot and more difficult to clean out.

Construction.—Houses should be built to face north or north-east, to protect from rain and wind, and to admit the sun's rays during winter. Greater protection from rain is given by projecting the roof in front or by building a small veranda.

The walls should be solid to prevent draughts. Where slabs are used for walls, the interstices should be covered by laths.

Plate 152.

Quantities.—The iron and timber required for building a house as per plan is as follows:—

3 in. by 2 in. hardwood for corner posts—Two 5 ft. 6 in., two 6 ft.

3 in. by 1½ in. pine battens for roof, back, and ends—Six 4 ft., two 5 ft. 6 in.

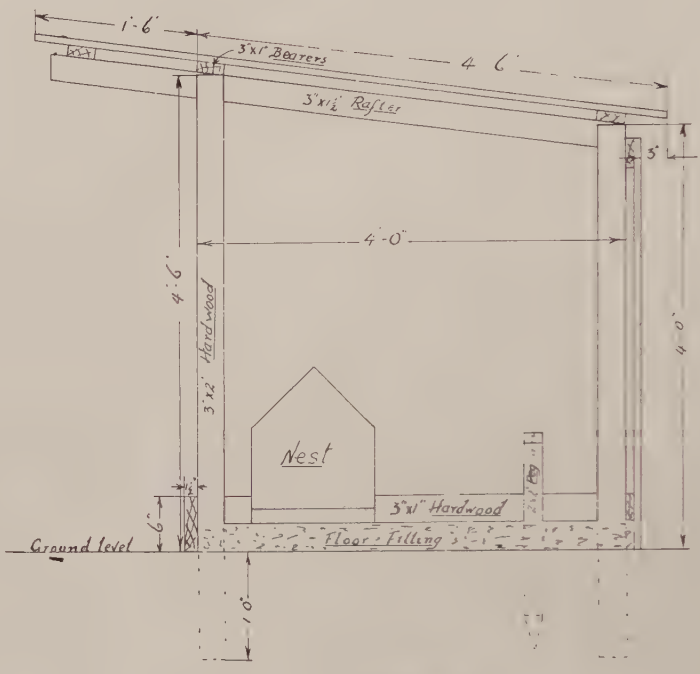
6 in. by 1 in. hardwood for front of house—One 4 ft.

Iron.—Roof, two 6 ft.; back, one 8 ft.; ends, two 9 ft.

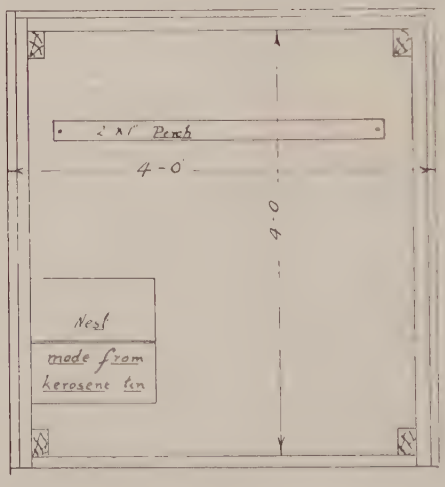
This material would cost about £2. Second-hand iron would reduce this expenditure.

Floor.—The floor of the house must be dry and hard, to have good sanitary conditions. Concrete floors are most desirable. Good hard floors can be made by using ant bed, well wetted and tamped. In order to ensure dry floors, raise them above the level of surrounding land.

Fittings.—In a house, perches and nests are necessary. The perches should be set up on pegs and made movable, as shown in plan. They should be erected 10 in. to 1 ft. from the back wall, and about 10 in. high. The nests should be placed in a shaded convenient position of the poultry house prior to the birds commencing to lay.



Section



Ground Plan

Drawn by W.F.B. 6/28

PLATE 153.

Netted Runs.—Fences should be 6 ft. high and posts 12 ft. apart. The bottom of the netting should be buried to a depth of 6 in. or well pegged down. The size of the run depends upon the numbers kept in any one flock. Always endeavour to have it large enough to prevent the roots of grass being eaten out. Where this is impossible, have two runs so that one may be dug over and planted with some gross feeder, such as rape.

Lesson II.

THE REARING AND FEEDING OF PULLETS.

Care on Arrival.

When club members receive their stock they will be about eight weeks of age, weaned from the brooder, and will have learnt to perch. Young stock do not take kindly to changes, and the habit of perching is often forgotten when the birds are shifted to new quarters.

Plate 154.

An illustration of how to bed chickens down, the straw being well banked up in corners.

Young stock that are not perching and have no brooder generally crowd into corners, with the result that some are smothered. Until the habit of perching is again acquired, place a good layer of dry straw on the floor, banking it well into the corners, for a bedding. Fork the straw over daily, shaking the droppings off the top and loosening the bedding for the birds to nestle in.

Factors Affecting Growth.

Ample range, feeding, clean water, cleanliness, separation of sexes, and vermin.

Range.—Stock on unrestricted range obtain large quantities of insect life, thus reducing cost of feeding. They consume freely of the tender shoots of grass. They have plenty of exercise, which assists in development. On free range, as a rule, good shade is available, and the land on which they run is not so foul as when they are penned.

Feeds.—All feeds contain moisture, ash, protein, fat, carbohydrates, and fibre in varying quantities. The body of the fowl contains similar substances in more definite proportions. In feeding it is essential to supply these substances in the quantities necessary to obtain good development.

Use of Food.—The food consumed by all growing animals is used—

1. To build up flesh.
2. To supply heat and energy.
3. To build up bone.

Proteins.—Proteins are organic compounds of carbon, hydrogen, oxygen, nitrogen, and sulphur.

Carbohydrates.—Carbohydrates are compounds of carbon, hydrogen, and oxygen.

Protein.—This substance is essential for the growth of flesh. Skim milk, lean meat, and insect life are rich in protein.

Carbohydrates and Fats.—These substances supply the heat and energy of the birds. One part of fat is equal to 2¼ parts of carbohydrates. Maize is rich in fat and carbohydrates.

Ash.—Among the ash from any food burnt is the mineral matter necessary for bone development. Foods rich in ash are skim milk, lucerne, and bonemeal.

COMPOSITION OF SOME POULTRY FOODS.

DIGESTIBLE NUTRIENTS.

Food.	True Protein.	Fat.	Carbo-hydrates.	Fibre.	Nutritive Ratio 1.:
Maize	6·2	3·5	65·8	1·8	12·1
Wheat	9·5	1·3	62·2	1·1	6·9
Kaffir corn	6·8	0·9	56·2	0·8	8·7
Bran	11·6	1·8	40·5	3·3	4·1
Pollard	11·9	3·1	54·0	2·1	5·3
Lucerne chaff	10·3	0·7	27·7	8·4	3·6
Milk (skim)	3·6	0·1	4·9	..	1·4
Buttermilk (powder)	32·5	1·1	49·1	..	1·6
Meat meal	42·0	7·0	4·5	..	0·5

The above table shows a great variation in constituents of different foods.

Feeding.—Experience teaches that about one part of protein is required to every four parts of carbohydrates and fats to obtain good development in poultry; that is, a nutritive ratio of 1 to 4 is required.

Maize has a nutritive ratio of 1 to 12, and if this grain is the only food given to poultry they will not make sufficient muscular development or good bone development.

One pound of maize fed in conjunction with 4 lb. of skim milk would give a nutritive ratio of 1 to 4·6. This food in addition to insect life would make a good ration.

Nutritive Ratio.—The nutritive value of a ration is ascertained by multiplying the fat content by 2·25, adding to the result the carbohydrate and fibre content, and dividing by the amount of protein.

Example—	Protein.	Fat.	Carbo-hydrates.	Fibre.
1 lb. Maize contains	·062	·035	·658	·018
4 lb. Skim milk	·144	·004	·196	..
	·206	·039	·854	·018

Fats ·039 x 2·25 = ·087
Carbohydrates = ·854
Fibre .. = ·018

·959

Ratio of Protein to Carbohydrates = ·206 : ·959
or = 1 : 4·6

Quantities.—With correct feeding there is no danger of giving birds too great a quantity. It is possible to make a ration of any desired ratio with one or two foods. A variety of foods should, however, be used in order to increase the palatability of a ration. The more palatable a ration is, the greater the consumption will be. If the ration is correct, increased consumption will lead to increased development.

Mash.—Mash is a term applied to a mixture of ground foods fed either in a wet or dry state. A suitable mixture for pullets under twelve weeks of age is 8 lb. bran, 12 lb. pollard, 1 lb. powdered buttermilk, 1 lb. bonemeal, and 2 oz. of fine salt.

From the age of 12 weeks to the laying stage the buttermilk may be replaced with meat meal and 3 lb. of lucerne meal added to the above quantities.

Skim Milk.—If ample supplies of skim milk are available, there will be no need to add powdered milk or meat meal to the ration.

Feeding Mash.—All mash foods must be fed in suitable receptacles. When wet mash is fed, it should be made crumbly (not sticky) and placed in dishes. In feeding wet mash, only quantities that will be consumed in half an hour should be given at one time.

When mash is fed in a dry state it is placed in hoppers and is constantly before the birds. The practice of dry-mash feeding ensures that the birds are receiving all they require.

Feeding Grain.—Grains are better fed during the evening at a fairly regular hour, say 4 to 4.30 p.m. The feeding of grain at this hour enables the birds to obtain a full supply of food of a slow digesting nature.

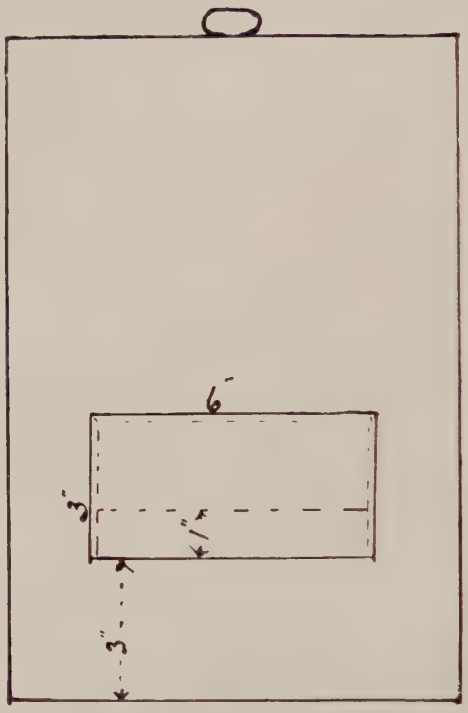


Plate 155.—Dry-mash Feeder.

A simple method of making a dry-mash feeding-vessel for a few growing pullets from a kerosene tin is to cut a hole 6 in. x 3 in. in one side, as shown in the sketch. All cuts to be made on dotted lines and the edges turned to prevent injuring the bird. That portion below the bottom dotted line to be rolled inside to prevent the food being scratched out. For matured stock a larger hole would be necessary.

Variety is desirable in the grain fed to poultry. A mixture could be made of cracked maize, wheat, and hulled oats. Hulled oats are fairly expensive, and in places unobtainable. Feterita and cracked maize could be extensively used and probably grown by club members.

Green Feed.—Green feed is rich in mineral salts. It assists in maintaining stock in good health, and supplies mineral matter. Use only young succulent growths for fowls. Rape, lucerne, barley, cabbage, lettuce, &c., all make suitable green foods.

Grit.—Grit is absolutely necessary for birds at all times, and particularly so when confined. It assists in supplying mineral matter and also is used in the gizzard for the purpose of food mastication.

Drinking Water.—Fowls drink frequently and use a good quantity of water throughout the day. In drinking, they immerse the beak and

soon dirty the water. The water should be renewed at least daily, and kept in a cool shaded position.

Drinking vessels for very young stock should be constructed so that there is no possibility of their being drowned.

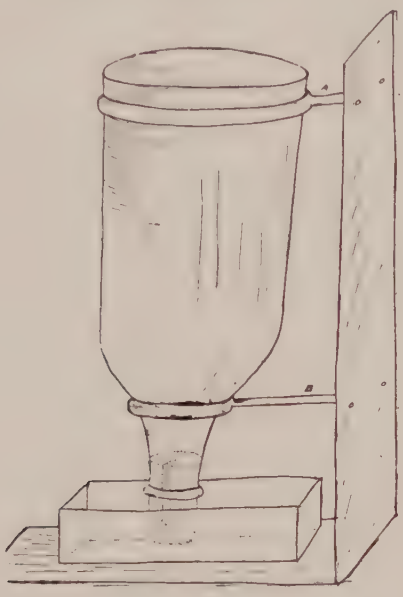


Plate 156.—Rough Sketch of Inverted Bottle and Tin for Water Supply to Young Chickens.

The bottle is supported by means of two hoops of wire or hoop iron at A and B to a piece of light pine. The upright is nailed to a foot on which rests a shallow tin where the chickens can drink. A sardine or tobacco tin serves well. A cork, having a V piece removed its entire length allows, when the water in the tin has fallen below the level of the mouth of the bottle, the entrance of air thereby replenishing the water supply.

Exercise.—Exercise is necessary for good development. When birds are confined to a small yard, litter such as straw, grass, leaves, &c., should be strewn on the ground for them to scratch among. To induce exercise, grain should be fed in this litter.

Cleanliness.—Cleanliness is a most important feature. Houses should be cleaned out weekly to prevent the atmosphere becoming objectionable. Weekly cleaning will assist in checking vermin infestation. Weekly cleaning, if thoroughly done, will indicate the presence of many varieties of vermin when, if prompt action is taken for their eradication, they will cause little ill effects.

The water vessels should be cleansed daily, as they are a source by which disease is easily transmitted from bird to bird.

Separation of Sexes.—As early as it is possible to distinguish males from females, they should be separated. This is possible with stock between the ages of six and eight weeks. Cockerels could then be forwarded to market, or retained until greater development had been made. The cost of feeding and market values for table poultry must govern what action is taken.

Adult Tick:

Adult tick feeds on bird at night.

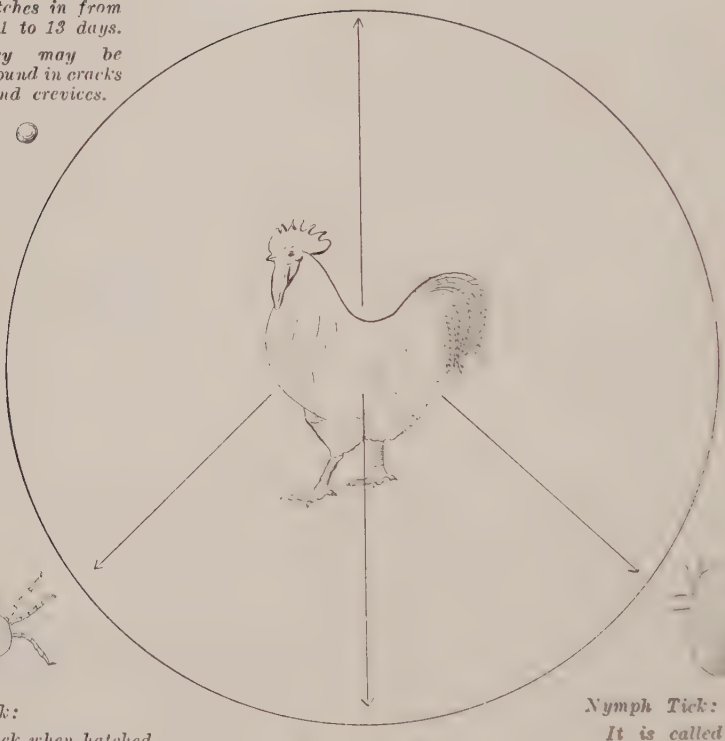
It lays from 20 to 100 eggs at one time.

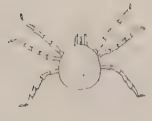
It may lay at eight different times.

Egg:

Hatches in from 11 to 13 days.

They may be found in cracks and crevices.





Seed Tick:

Seed tick when hatched is white in colour.

It has six legs.

It attaches itself to fowl to feed.

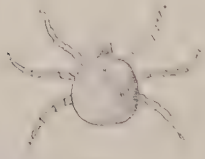
Nymph Tick:

It is called a nymph tick after moulting.

It now has eight legs and lives in cracks and crevices.

It feeds on the bird at night and then moults.

This process is usually repeated three times before the tick is fully grown.



Engorged Seed Tick:

Leaves fowl after feeding from 4 to 10 days.

It is then bluish-grey in colour.

It seeks shelter in cracks and crevices and then moults.

PLATE 157.

Lesson III.

EXTERNAL PARASITES.

Principal External Parasites.

Feed on blood .. .. { Poultry tick / Red mite

Feed on skin and feathers .. .. Body lice of all kinds.

Poultry Tick.

The tick passes through many stages before reaching maturity. The life cycle of the tick may be briefly described as follows:—

1. The adult female lays eggs in batches of 20 to 100.
2. Eggs hatch in eleven to thirteen days according to climatic conditions.
3. Young tick (seed tick) attaches itself to the fowl, where it remains from four to ten days.
4. After engorging, the seed tick leaves the fowl.
5. After moulting, the seed tick is known as a nymph tick. It feeds again and moults. This process is repeated usually three times.
6. The female tick when fully grown feeds and lays. It may lay as many as eight batches during its life, but feeds between each laying period.
7. The time occupied in passing through all these stages is usually about ten months.

Appearance.—The tick egg is about half the size of the head of a small pin, circular in shape, shiny, and almost colourless. With age it turns a yellowish brown. The seed tick, before feeding, is naturally very small and almost white in colour. It has six legs. After feeding, the tick swells up considerably and is darkish in colour. It still has six legs. The nymph and adult ticks can easily be distinguished by their elongated oval bodies and size. They then have eight legs. When unengorged they are of a dirty yellowish colour, but after feeding they become bluish grey.

Habit.—The seed tick, on hatching, makes its way to the fowl and attaches itself under the wing or leg to feed. This feed may last from four to ten days. On feeding, it leaves its host and secrets itself in cracks and crevices, and moults.

The adult tick and nymph tick may be found hiding in the cracks and crevices of perches, under the perch, in woodwork of poultry house, bark of trees, fowl crates, and, in fact, any place where poultry are kept.

The tick, after its first moult, that is, when it has eight legs, only passes onto the fowl for an hour or so during the night for the purpose of feeding.

Effect.—The poultry tick, by sucking the blood from the fowl, weakens it and reduces the egg yield. It also frequently transmits to poultry a disease known as tick fever. Tick fever is responsible for

heavy mortality. This fever causes a rise in temperature of the bird, diarrhœa, loss of appetite, ruffled plumage, darkening of the comb, and, in many cases, the loss of the use of limbs before the bird dies. Some birds recover from this disease and are immune to future attacks.

Treatment.—Ticks must be destroyed, as treatment for tick fever is impractical. Thorough spraying of fowlhouses at intervals of five days, until the ticks are eradicated, is necessary.

Spraying Mixture.—The spraying mixture that is most economical and efficient is kerosene emulsion. This is made as follows:—Take 1 gallon of water and boil with 1 lb. of good household soap. When boiling remove from the fire and stir in 1 gallon of kerosene. Do this gradually and so get a good emulsion. To this then may be added another 8 gallons of water. In making this spray, use only soft water and, in using the mixture, spray freely.

Longevity of Ticks.—The length of life of the poultry tick is an unknown quantity. Cases have been known of isolated ticks living without feeding on a host for four years and five months. From this it will be seen that it would be most difficult to starve ticks out.

Plate 158.—Red Mite.

Red Mite.

What it is Like.—The red mite is very minute. When fully grown it is not much larger than the dot used for the marking of the letter "i." Adult mites have eight legs. They are red in colour when engorged with blood, but before feeding they are white. It only takes eight days for the mite, from the time it leaves the egg, to become fully grown; and, as a mite may live for four months, it will be understood that they multiply very rapidly under favourable circumstances.

Habits.—The mite lives in the cracks of perches, between the perch support and perch, in cracks of the nest boxes, walls of houses, and,

when very numerous, among the droppings and litter in the fowlhouse. They feed on the bird at night by sucking blood, and seek shelter before daybreak in secluded positions.

Effect.—Mites are responsible for reduced egg yields among laying hens on account of the loss of blood, irritation, and broken rest they cause. Young stock, when attacked by mite, do not thrive, and the health of all classes of birds is impaired to such an extent that they fall ready victims to disease organisms.

Treatment.—Light degree of infestation:—Paint perches and perch supports with a mixture of kerosene and waste oil.

Heavy infestation:—Remove from the fowlhouse all loose earth, boxes, perches, &c., and spray thoroughly with a kerosene emulsion, saturating the floor. Treat perches likewise and replace old nest-boxes with new ones. Repeat every week until the pest is eradicated.

Plate 159.—Common Louse of the Fowl. (Magnified 37 Times.)
From Victorian "Journal of Agriculture."

Body Lice.

There are many varieties of body lice to which poultry of all kinds are subject. All species of birds have their particular species of lice. Those found on the duck will not be found on the fowl. On the fowl may be found lice of several varieties. Some varieties will be noticed crawling about the skin of the body, while others will be adhering to the feathers.

Lice live on either the outer layers of the skin or the feathers, and this fact accounts to some extent for the position in which lice are noticed.

Effect.—A few lice, with one exception, on a bird appear to cause very little inconvenience. The exception is a louse about one-tenth of an inch long, dark in colour, which lives on the neck and head. Even this louse causes little ill-effect on adult stock, but with chickens and young growing stock it is responsible for heavy mortality.

When lice of any variety, however, are numerous, they cause considerable irritation, with the result that young stock do not thrive and adult stock cease to be profitable.

Male birds are usually infested to a greater extent than females, and become very thin and weak from the effects of lice. This is due to the fact that they do not dust bath as freely as females. Males should be periodically examined and, if infested, receive special attention.

Treatment.—For head louse, which causes such heavy mortality among chickens, it is necessary to catch every bird and lightly smear the feathers around the head and under the beak with olive oil.

Plate 160.

This seven-weeks-old Single Comb White Leghorn cockerel is suffering from an attack by head lice. Note the unkempt plumage, dark, dried comb, eyes closed and general dejected appearance.

Dust Bath.—Dust baths can be composed of fine road dust and wood ashes. To the dust bath may be added in small quantities flowers of sulphur, tobacco dust, or slaked lime, to make it more effective, but it will be found that by keeping the dust bath slightly moist, particularly in warm weather, the birds will use it more freely and there will rarely be any necessity for making these additions.

Males infested with body lice should be dusted with some good insect powder at fairly frequent intervals, and all feathers around the vent to which lice eggs are attached should be removed. For the flock in general it will be found that a good dust bath will keep lice down to numbers that will not cause discomfort of the stock.

Lesson IV.

INTERNAL PARASITES.

The principal internal parasites of poultry may be referred to as round worms and tape worms. There are many varieties of each kind. Other lower forms of life are parasitical upon birds, but they will be dealt with in "Diseases."

Round Worm.

Round worms may be found varying in size from $\frac{3}{8}$ in. in length and as fine as a piece of cotton to 3 in. in length and as thick as a wax match. This class of worm, as the name indicates, is round. Varieties of this worm may be found in the crop, stomach, gizzard, intestines, and blind gut.

The round worm is commonly found in the intestine and blind gut. The largest worm will be found in the former, while small worms $\frac{3}{8}$ in. to $\frac{3}{4}$ in. in length are found in the latter. Gizzard, crop, and stomach worms are not common.

Tape Worm.

Tape worms vary in size to a greater degree than round worms. Some are so small that it requires a hand lens to detect them, while others may grow to the length of a foot or more.

Tape worms confine their attention to the intestines. The small ones embed themselves in the walls of the intestines, forming small lumps or nodules, and the large hang on by the head, the tail portion floating among the intestine content. The tape worm, as the name suggests, is flat. It is made up of numerous small segments of a chain-like formation, and as the rear portion matures it detaches itself from the chain.

Symptoms of Worm Infestation. Stock infested with worms become dull, weak, and emaciated. They are sunken in face, and lose colour from both the face and legs. The plumage loses its lustre and has a ruffled appearance. With a medium degree of infestation, stock are ravenous feeders, but as the worms increase in numbers their appetites diminish. They become very stilted in their movements and frequently have diarrhœa.

When several birds in any one flock present the foregoing appearance, worms should be suspected, particularly so if the flock has been well cared for. A more definite opinion can be gained, however, by making an examination of the internal organs of one or more of the weedy looking birds.

Life History of Worms.

In order to intelligently cope with worms, it is necessary to have some idea of how birds become infested. The life-cycle of many worms which trouble poultry has not been studied, but sufficient is known of the more common to enable control measures which prove highly satisfactory, to be adopted.

Plate 161.—Portion of Intestines of Fowl Infested with Worms.

This interesting photo of worm infestation was obtained by the writer from a white leghorn pullet. The owner had requested the Department of Agriculture to advise on the treatment of his flock for roup. There was no doubt that the low condition of the birds was largely responsible for their susceptibility to the disease, and all those that were opened for examination showed severe worm infestation. Outbreaks of disease among such stock must be expected.

There is a distinct difference between the life-cycles of round worms and tape worms, but methods for control are not dissimilar, sanitation playing a most important part in both. The life-history briefly is as follows:—

Round Worms.—The worm in the intestine lays its egg, which is voided with the excreta. The egg lies on the soil for some time and undergoes partial development. Moisture is necessary. The bird consumes the partially developed egg adhering to particles of food. The partially developed egg, on entering the digestive tract, hatches. It then commences to feed according to its habit, matures, and lays eggs.

Tape Worms.—The ripe segment of the tape worm is voided with the excreta. This segment contains matured eggs. Flies, slugs, and worms feast on the droppings, taking the eggs into their digestive tract. The egg here hatches, the young penetrating the walls of the intestine, encysting itself in the abdominal cavity. The fly, slug, or worm is then consumed by the bird, with the result that an adult tape worm develops from the encysted stage.

Prevent Infestation.—The round worm is spread from bird to bird by worm eggs. Therefore the following practice should be adopted:—

Never introduce infested stock on to clean premises.

Avoid rearing chickens on land where adult stock have been running.

Have chicken-rearing pens in a position not easily fouled with the washings from adult pens.

Regularly clean poultry houses and pens to reduce the numbers of worm eggs about the premises.

Keep poultry houses and pens as dry as possible.

It is seen that tape worms require an intermediary host, and that they feed on the excrement containing segments of the worms. The regular cleansing of poultry houses and yards will reduce to a great extent the possibility of the tape worm coming in contact with intermediary hosts.

Moist places, such as under boards, bags, feed hoppers, are favourable places for slugs and worms to find cover. Therefore do not have yards littered with such.

Treatment.—No medicament is 100 per cent. efficient, and all treatment needs to go hand in hand with prevention. Otherwise birds are freed from a few worms only to be reinfested.

Round Worm.—Any of the following will prove fairly effective, but individual treatment is recommended:—

1. Mix 1 lb. tobacco dust with every 50 lb. of mash.

2. One or two teaspoonfuls according to age, of equal quantities of medicated turpentine and cotton seed or linseed oil.

This is best administered with the aid of a syringe and a piece of rubber tubing. Draw the dose into the syringe. Place the tube down the bird's neck until the lower end enters the crop, then eject the mixture. This care is necessary, for if the mixture entered the windpipe it would cause asphyxia.

3. For small flocks, capsules containing effective worm medicaments could be obtained.

Tape Worm.—1. One heaped teaspoonful of powdered pomegranate bark added to the mash for fifty birds.

2. Ten grains areca nut given in mash for each bird.

3. Kamala at the rate of 15 grains in mash.

The above is the dose for adult stock. Half-grown birds should receive half the quantities.

Before administering any worm remedies, the birds should be fasted for twenty-four hours. This is best done by not feeding an evening meal and treating stock the following morning. Follow all treatment in the course of two hours with a dose of salts, at the rate of 1 oz. to the gallon of drinking water.

PLATE 162.—TAPE WORM.

a.—Worm;

b.—An inverted piece of chicken's intestine with numerous tape worms attached.

Lesson V.

COMMON DISEASES.

The diseases that frequently occur among young growing stock are chicken-pox, canker, roup, leg weakness, and scaly leg.

The three former troubles are of a highly contagious nature, and the methods that should be adopted for the prevention and control of all are similar. In considering how to control and prevent disease, the two following points have to be borne in mind:—

1. Stock in good sound physical condition are not so susceptible to diseases as those that are weak and weedy.
2. Disease organisms do not multiply rapidly when poultry houses are kept in good sanitary condition.

Disease Prevention.

To maintain stock in good physical condition, the following conditions must apply:—

1. The stock must be the offspring of sound parents.
2. They must not be overcrowded at any stage of their life.
3. An ample supply of suitable foods must be given.
4. Every precaution must be taken to prevent their being preyed upon by both internal and external parasites.

To maintain the premises in good sanitary condition the following points have to be considered:—

1. Site on which buildings are to be erected.
2. Roofing of fowl sheds.
3. The drainage around fowlhouses and runs.
4. The regular cleaning of the houses and runs.

Disease Control.

The first point of control is to isolate any sick bird and to remove any bird to other quarters which shows the slightest signs of trouble. Pens and runs should be thoroughly cleaned, despite the fact that they may have received recent attention.

After the cleaning, the sleeping quarters should be thoroughly sprayed with some good disinfectant. The water vessels are a medium by which disease is very easily transmitted, and they should be cleansed and disinfected daily.

If the custom has been to feed dry mash, wet mash should be substituted. Feeding troughs should be emptied, say, half-an-hour after the mash has been distributed. The troughs should then be disinfected.

In the event of an outbreak of disease, the above methods should prevent its rapid spread among the flocks and, in time, eradicate it, but it is necessary to be able to detect disease and treat sick stock.

CHICKEN-POX.

This disease affects all classes of poultry, but is more pronounced among young stock, particularly those hatched late. It is prevalent during the period from November to April. Once stock have been affected, they appear to be immune to further attacks.

PLATE 163.—CHICKEN-POX ON COCKEREL.

Symptoms.—Wart-like growths are noticed on the bare parts of the head and comb. In early stages these warts are little more than small yellow eruptions. When the disease is severe, there is an elevation of temperature, disminished appetite, and general dullness.

Treatment.—Isolation of sick birds and painting of wart-like growths daily with one of the following:—

1. Carbolised glycerine –1 part carbolic acid and 15 parts glycerine.
2. 5 to 10 per cent. solution of iodine.
3. 10 grains silver nitrate to 1 ounce of water.

Canker.

All classes of poultry are subject to a cheesy-like growth in the mouth. This is termed "Canker," and it frequently associates itself with chicken-pox and roup.

Symptoms.—The symptoms are not very pronounced, as affected birds frequently appear to be perfectly healthy. It may be noticed at times that a bird has difficulty in closing its mouth or in swallowing. Examination may show a cheesy-like growth on the upper or lower portion of the side of the mouth or sometimes on the windpipe.

Plate 164.

The lower jaw of two birds, showing canker growths. Note how tongue is displaced by pressure from growths.

Treatment.—Isolate affected bird. Remove as much growth as possible with a small piece of smooth wood. Paint surface with 10 per cent. solution argyrol, 10 per cent. solution iodine, or dust with small quantity of powdered bluestone.

If the disease persists, despite daily treatment, destroy the bird.

Roup.

The term "Roup" is applied in a general sense to a discharge of a catarrhal nature of the nostril (contagious nasal catarrh), inflamatory condition of the eyes (eye roup), discharge from the nose and lesions in throat and mouth (diphtheritic roup).

Contagious Nasal Catarrh.

Symptoms.—Discharge from nostril of very offensive odour, causing litter and dirt to adhere to beak. Breathing from the mouth on account of stoppage of nostril. Continued sneezing to free nostril. Sick birds stand apart from flock with ruffled feathers and drooping wings. Loss of appetite.

Plate 165.—Advance Stage of Contagious Catarrh.
Nostrils blocked. Collection of mucus forcing mouth open.

Treatment.—Destroy birds badly affected. Isolate any to be treated. Submerge head twice daily for about half-a-minute in one of the following solutions to thoroughly cleanse nostrils:—

1. Equal quantities of hydrogen peroxide and water.
2. A 2 per cent. solution of permanganate of potash.
3. Ten grains of silver nitrate to the ounce of water.

In addition, administer one teaspoonful twice daily of olive or cotton-seed oil to which has been added three drops of kerosene and three drops of eucalyptus.

Eye Roup.

Symptoms.—Eyelids become stuck together with the discharge. This causes a pronounced swelling, and, on the eyelids being prised apart, a cheesy-like substance can be seen. It may affect one or both eyes, one eye usually.

The inflammatory condition causes intense irritation, and the bird is constantly wiping its eye on the wing, with the result that the feathers are soiled.

Treatment.—Isolate affected birds. Force apart the eyelids and remove collection of solid matter. Submerge head, as recommended for nasal catarrh. Place in eye twice daily one or two drops of a 10 per cent. solution of argyrol.

Plate 166.—Eye Roup in Early Stages.
The dirty patch on the wing is a warning of eye trouble.

Diphtheritic Roup.

Symptoms.—Discharge from nostril of a very offensive odour. Rise in temperature and thirst, and sometimes diarrhœa. Patches of greyish or yellowish growth tissue appear in mouth and throat. Loss of appetite and disinclination to move about.

Treatment.—Destroy severely-affected birds and isolate those to be treated. Cleanse head as recommended for catarrh. Remove as much of the growths in mouth and throat as possible without causing bleeding.

Paint the raw area with any of the following:—

1. 10 per cent. argyrol.
2. 10 per cent. iodine.
3. 10 grains of silver nitrate to the ounce of water.

Renew drinking water three times daily, and add sufficient permanganate of potash to make it a good pink colour.

Leg Weakness.

Symptoms.—The bird may suddenly lose the use of one or both legs or, in the early stages, there may be a slight stiltiness of walk noticed.

Cause.—Due to diet deficiency, intestinal worms, disease, or damp quarters.

Treatment.—Leg weakness does not respond too readily to treatment. Ascertain the cause and try and remove it. Paint affected leg with 10 per cent. iodine.

Plate 167.—Advanced Stage of Scaley Leg.

Scaley Leg.

Symptoms.—Roughened appearance of the leg on account of the elevation of the scales due to a collection of a whitish crust.

Cause.—A small mite which lives on the skin under the scales.

Treatment.—Paint legs and feet with one of the following:—

1. One part kerosene and one part oil or fat.
2. Carbolised glycerine.
3. Equal parts sulphur and lard.

FODDER CONSERVATION.

AN ANALYSIS OF REQUIREMENTS.

The importance of "stock insurance" by means of fodder conservation was emphasised in these notes recently when the financial advantages of the security so afforded were pointed out. Discussing the requirements of such a scheme, the departmental writer from whose report these paragraphs are taken sets out a dual objective, namely—

1. Provision of adequate fodder supplies for the requirements of the farm.
2. The conserving of a marketable surplus.

The main considerations in the firstmentioned are—

(*a*) Ample reserve to cover requirements;
(*b*) The provision of a well-balanced ration;
(*c*) Provision of a suitable and effective protection against fire, flood, and damage from mice, stock, &c.;
(*d*) Location of reserves with a view to ease and cheapness of feeding;
(*e*) Cost of conservation.

A safe guide in assessing the quantity of fodder required for one's own use may be based on the following ration for one sheep per day:—

1 lb. cereal or lucerne hay;
4 oz. grain (crushed oats for preference);
2 lb. silage.

Roughly, 122 tons of hay, 31 tons of grain, and 244 tons of silage are required for feeding a flock of 1,000 sheep for a period of nine months. It is a wise precaution, however, to carry reserves capable of tiding one over twelve months.

The provision of a well-balanced ration is essential. Stock continually eating one particular class of fodder generally evince a dislike for it after prolonged feeding, and fail to maintain the same condition as in the early stages of feeding.

Protection of Stored Fodder.

Adequate protection of the fodder stored is essential, both from a directly economic point of view and in relation to the accurate assessment of one's stocking capacity—it is hard to estimate one's loss when on opening up drought reserves one finds a large percentage unfit for consumption. In the case of stored hay, dunnage should be placed under all stacks to obviate damage from absorption of moisture from the soil. If possible hay straddles of an approved design should be erected, more especially where oaten hay is concerned and intended to be stored for a number of years. This particular class of fodder is most liable to damage from mouse infestation. Well sloping roofs, suitably thatched, are very desirable, and amply repay the additional cost involved.

When thatching, the use of the tie wire in place of binder twine will be found to give more satisfactory results. Weather soon rots the twine, necessitating repair usually in the second year. Again, in stack construction, the higher the walls can be carried the greater the compaction and the less likelihood of damage from mice. The cost of sound stock proof fences round stacks is fully justified by the protection afforded. Where possible, hay stacks should possess at least a small measure of cover by insurance. In addition, fire breaks should be made a suitable distance from one another so that in the event of fire only an isolated stack is destroyed.

Protection of Silage.

In many cases due attention is not paid to the protection of silage. In the first place it is highly desirable to allow the pit to settle during filling operations, which latter should never be too hasty. After allowing time for settling, the silage should be built above ground level to a height equal to the depth of the pit. This prevents the covering sinking below ground level and forming a miniature dam for the accumulation of water, and subsequent percolation and damage. The covering should be of ample depth (2 ft. 6 in. at least). The use of horses driven backward and forward while topping the pit will do much to consolidate the earth and leave an impervious top. The covering should be nicely moulded up with a good slope and suitable drains placed down each side of the pit at the surface to carry off all water.

In the selection of sites for silo pits, due consideration must be given to surface drainage and to the possibility of strata resulting in seepage into the pits.

Iron Bins for Grain.

Grain is most satisfactorily stored in galvanised-iron silos. This method of conservation is fast gaining popularity, and is certainly superior to storage in sheds. The advantages of such bins lie in the facts that they are mouse and weather proof, and their construction permits of fumigation of the grain if necessary. They also have the big advantage that at the termination of feeding the remainder of the fodder is safely conserved without further expense in protection, as is the case with hay stacks and silo pits when they have been opened and their contents not fully consumed.

Where possible, reserves should be in close proximity to water and feeding paddocks, expense in feeding being thereby minimised.

Attention should be given to the baling of hay for drought reserves. Greater protection is afforded from mice by storage in sheds, less space is occupied, and when feeding out it is more economical to handle, and the ration fed is more easily computed. Moreover, it is in a handy form to market immediately if desired.

In studying the costs of fodder conservation, the aim should be to obtain the greatest measure of protection with the minimum of expense. Where large areas of lucerne are cut, the adoption of modern machinery for handling it should receive consideration.

The marketable surplus referred to earlier is best confined to cereal or lucerne hay and oat grain.—"A. and P. Notes," N.S.W. Dept. Ag.

MALNUTRITION.*

By J. C. BRÜNNICH, Agricultural Chemist.

A GREAT majority of our pastoralists had during the last few years a very serious setback on account of drought conditions, and therefore it became necessary to give some advice as to how such conditions may be mitigated, by drawing attention to mistakes made by many and beneficial results obtained by others through the use of licks, &c., during the past season.

The great aim of all animal husbandry is increased production, and this again depends almost entirely on the feeding of stock. Any errors in the feeding will cause malnutrition and disease.

Food Constituents.

Every one is familiar with the chief constituents of foods, which are—

(1) Proteins, nitrogenous compounds, the important flesh-forming nutrients;

(2) Carbohydrates (as sugar, starch, &c.) and fats, all nitrogen-free compounds which build up fatty matter and produce heat and energy;

(3) Mineral matters, which enter into the formation of bones, teeth, blood, and other fluids of the body; and finally

(4) "Vitamines," accessory foodstuffs of which very minute quantities are required for a complete maintenance of health and normal development of the animals, and generally well supplied in green pasture.

The requirement of mineral matter or salts received but very scanty attention until recent times.

The fact that all foodstuffs contain certain amounts of mineral matter, left in the form of ash, when fodders are burned, was well known, and it was generally accepted that any animal fed in a natural way on common ordinary rations like grass, hay, and grain, would receive a sufficient amount of the mineral constituents with the food, which supplied the necessary amounts of proteins, fat, and carbohydrates for its maintenance and growth.

In all living matter the following inorganic constituents are found:—The non-metallic elements—Phosphorus, sulphur, silicon, chlorine, iodine, and fluorine. The metallic elements—Potassium, sodium, calcium, magnesium, iron, manganese, and aluminium; and probably traces of several other elements.

*A summary of lectures delivered to the pastoralists in different centres along the Great Northern and Central Railway Lines.

It is a false idea to think that the minerals are required for bone formation only. The inorganic constituents are as essential to animal life as the ordinary organic food constituents, proteins, fat, and carbohydrates. The most important function of the food minerals are performed in the soft tissue and in the blood, where they are essential constituents of living matter, and therefore they stimulate and control directly or indirectly all vital processes.

Functions of Mineral Constituents.

The chief functions of the mineral constituents performed in the animal body are the following:—

1. They are necessary for the maintenance of a proper physiological balance between the mineral elements in the body fluids. Any excess or deficiency of any one of the mineral constituents will affect the vital processes. A deficiency of potassium in the blood will act on the heart muscle and prevent it from relaxing properly, while an excess makes it relax so much that it stops beating. Common salt is an absolute necessity for nutrition, but given in excess will act as a poison and cause serious troubles. The mineral constituents maintain the practically neutral reaction of the blood.

2. They are necessary for the process of digestion. The digestive processes are affected by acidity and alkalinity of the digesting fluids. In the stomach an acid reaction must exist to aid in the pepsin digestion, whereas in the small intestine an alkaline reaction is necessary to allow the trypsin to act. The absorption of the digested products again is controlled by the concentration of the salts, and this concentration will also affect the passage of digested and undigested material along the intestines.

3. Mineral constituents are required as constructive material for the formation of new tissue and building up of the bone skeleton.

4. Milking animals require larger supplies of mineral matters to keep up the yield and average composition of the milk secreted.

Considerations of Modern Research.

Modern research dealing with the mineral nutrition of farm animals has to consider—

1. Mineral requirement of the various species of farm animals.
2. The correct balance or proportion between the different constituents.
3. Relationship between the inorganic and organic portions of the ration.
4. Effect of ouside factors, like sunlight and exercise on the mineral metabolism.
5. Study of diseases caused by faulty mineral nutrition.
6. Mineral constituents of various food stuffs.

1. Of the mineral elements required in the largest amounts for growth, &c., calcium or lime and phosphorus or phosphoric acid stand out on their own, and this is very clearly indicated by the large amounts of both found in the milk of the lactating animals. It will be noticed that the faster the growth of the young animal, the greater the amount of mineral matter required and supplied by its mother's milk.

Species.	Time Required to Double Weight.	Composition of Milk.					
		Protein.	Fat.	Sugar.	CaO.	P_2O_5	Ash.
	Days.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Woman ..	180	1·6	3·3	6·2	0·049	0·056	0·25
Horse	60	1·8	1·2	6 9	0·120	0·130	0·30
Cow	47	3·5	3·8	4·8	0·161	0·189	0·75
Sheep	15	6·7	8·6	4·3	0·250	0·290	0 97
Pig	10	7·2	4·6	3·1	0·395	0·357	1·05
Rabbit	6	15·5	10·5	2·0	0·89	0·99	2·56

For every 100 lb. of live weight a sheep or a pig requires about 1 lb. of lime and nearly 1 lb. of phosphoric acid, a calf requires about double these amounts and rather more phosphoric acid than lime. As a rule only about one-half of the

lime and phosphoric acid supplied in the food can be assimilated and retained, and therefore the actual amount of food consumed should contain at least double the quantities absolutely necessary.

2. The balance or proportion between the different mineral constituents is now recognised to be of importance, and any serious alteration in the balance between two or more elements may affect assimilation, not only of these elements, but also of other constituents of the ration.

3. The relationship between inorganic and organic constituents of rations is shown by the fact that a ration which contains ample amounts of protein fat and carbohydrates may fail to produce normal growth if it is deficient in one or more of the mineral constituents. Addition of such will at once give increased growth and a much better utilisation of the food stuff.

4. Experiments have shown that sunlight and even artificial irradiation, lead to an improved lime and phosphorus assimilation, and may even make up for the want of vitamine D.

5. Diseases due to deficiencies of mineral matters have been reported from all parts of the world, and a concentrated attack to deal with such diseases is being made the last few years throughout the Empire.

Investigations on Phosphorus Deficiency.

Sir Arnold Theiler, with a large staff of workers, made a very complete investigation on phosphorus deficiency as the cause of several diseases in South Africa, which were completely checked by giving the cattle liberal doses of bonemeal.

A full copy of his report appeared three years ago in the "Queensland Agricultural Journal" for March, 1925. Unfortunately, not much notice of the importance of his discovery was taken by readers at the time, and only his personal visit to the Commonwealth gave a fresh stimulus to this matter, more particularly as both he and Dr. J. B. Orr, Director of the Rowett Research Institute, Aberdeen, another oversea visitor to our States, clearly recognised similar wants in our pasture as well as clear signs of malnutrition. The principal sickness due to phosphorus deficiency in South Africa, is the Styfsiekte or stiffsickness, with its most obvious outward sign of bone chewing, or osteophagia. This is a specific form of depraved appetite, showing by cattle having a predilection for bones, chiefly bleached bones. In more aggravated cases even putrifying bones and rotten carcasses are eaten. The animals are easily tested in practice if they are marked cravers, slight cravers, or non-cravers, which is very useful for experimental purposes. The osteophagia is a precursor of serious diseases, stunted growth, poor condition, and heavy mortality. Feeding the animals with 3 oz. of bonemeal per head per day absolutely controls the disease, and enormously improves the condition of the cattle.

A few diagrams shown in Sir Arnold Theiler's report, which is republished in full in the September number of the Journal, clearly demonstrate the improvement in growth, increase of food consumed, &c. Particularly interesting is the quick change which takes place when batches of the experimental animals have their treatment reversed, the controls receiving bonemeal, and the bonemeal withdrawn from others. The change in the animals manifests itself in a very short time, and the recovery of some is simply marvellous.

Seasonal changes should also be noted, and the quick improvement in cattle following spring rains.

The phosphorus was supplied in various forms, but the results obtained were the same. Addition of lime did not prevent osteophagia, but rather increased the evil. Bonemeal as the best and cheapest form of phosphatic available in South Africa was chosen for general use. Mineral phosphates were tried, but were found too costly and rather difficult of digestion; superphosphate was found to cause digestive troubles. Precipitated calcium phosphate behaved very much like bone phosphate. In finely ground Nauru and Ocean Island phosphate we have a natural pure tricalcic phosphate which can be safely used in place of bonemeal.

Application of phosphatic fertilisers to pasture, in South Africa using 500 lb. superphosphate per acre, produced the same results as bonemeal feeding, but, of course, this is of not much practical value to our pasturalists, as phosphatic manuring on a large scale would not be an economical proposition.

The want of phosphorus was traced by Sir Arnold Theiler and his co-workers to the pastures and to the soil itself, and in all the affected areas, the soil showed a great lack in available phosphoric acid, being generally less than .001 per cent.

There can be no doubt that our stock suffer to some extent, more so in certain districts, from a phosphorus deficiency, which becomes more evident and pronounced in drought periods. A supply of phosphorus just or barely sufficient for maintenance is quite inadequate for reproduction and growth. Sir Arnold Theiler's results showed that a breeding cow requires in the earliest stage of pregnancy only about 2 oz. of bonemeal per head per week more than an ox, whereas in an advanced stage of pregnancy as much as 28 oz. bonemeal per week were required to prevent osteophagia.

Comparison of Composition of Pasture Grasses.

Of particular interest is the study of the following table giving the composition of pasture grasses as found in South Africa, in Queensland, &c., as compared with good European pasture.

	Analysis of Water Force Material.				
	Protein.	Fibre.	Ash.	CaO.	P_2O_5.
	%	%	%	%	%
Fattening Pasture, Romney Marsh, eaten ..	22·9	20·2	8·7	0·99	1·01
Fattening Pasture, Romney Marsh, non-eaten	13·5	28·2	5·6	0·75	0·65
Non-fattening, Romney Marsh, eaten ..	21·1	20·2	7·6	0·90	0·89
Non-fattening, Romney Marsh, non-eaten ..	12·3	29·2	5·6	0·73	0·58
Poor Average Pasture, England, eaten ..	15·9	25·2	5·5	0·56	0·60
Poor Average Pasture, England, non-eaten ..	11·4	29·3	3·1	0·30	0·37
Pasture, Falkland Island, eaten	12·2	..	4·6	0·29	0·54
Pasture, Falkland Island, non-eaten	7·0	..	2·5	0·14	0·25
Mixed Pasture, South Africa, November ..	19·4	22·5	11·6	0·31	0·60
Mixed Pasture, South Africa, January ..	13·8	25·0	7·7	0·50	0·22
Mixed Pasture, South Africa, March	7·2	33·7	5·9	0·43	0·24
Mixed Pasture, South Africa, May	4·1	34·9	5·9	0·50	0·07
Mitchell Grass, Queensland, green, 1926-27 ..	7·9	31·7	10·9	0·62	0·38
Mitchell Grass, Queensland, yellow, 1926-27 ..	6·0	28·9	10·7	0·44	0·20
Mitchell Grass, Queensland, roughage, 1926-27	2·8	32·9	10·0	0·38	0·12
Mitchell Grass, Queensland, midgrowth, 1913-14	5·5	41·0	12·3	0·57	0·37
Queensland Average Mixed Pastures (15 samples)	6·3	41·2	11·9	0·49	0·45
Paspalum Pasture, Unfertilised, 9 days old ..	8·2	25·4	12·7	0·72	0·55
Paspalum Pasture, Unfertilised, 44 days old	6·8	29·8	11·9	1·15	0·37
Paspalum Pasture, Fertilised, 9 days old ..	15·5	24·1	13·3	0·50	0·66
Paspalum Pasture, Fertilised, 44 days old ..	7·4	35·9	10·2	0·63	0·40

The most striking feature is the high percentage of protein, lime, and phosphoric acid, calculated on the water free material, found in the pastures readily eaten by sheep on Romney Marsh, England. The pasture not eaten is still very much richer than the best of our own pastures. On Falkland Island, which is heavily stocked, a considerable falling off in the stamina of the sheep has been noted and is due to the fact that the pasture was never fertilised. The mineral constituents lime and phosphoric acid are very low. The great falling off in nutritious quality of the South African pastures with age is clearly shown, more particularly the great reduction in the phosphoric acid contents of the ash, which is quite good in November, becomes already low in January and March, and falls away to practically nothing in May.

A similar condition exists in the Mitchell grass pasture and a distinct want of phosphoric acid in the older growth is to be noticed.

The great increase in the protein contents of paspalum pasture due to application of a complete fertiliser, with an extra supply of nitrogenous manure, is also worth noting.

Lack of Protein.

It has been found that the supply of lick will lead to greater consumption of fodder, and greatly help in the digestion and assimilation of all nutrients, but after all it cannot create protein if it is not there, and the actual value of a

feed must depend principally on the amount of protein it supplies. I have repeatedly expressed the opinion that our stock are suffering for long periods of their existence of a protein starvation, with or without lime and phosphorus deficiencies. Lime itself is but very rarely deficient, but phosphorus is, although not in such a pronounced degree as found by Sir Arnold Theiler in South Africa. Only in very isolated cases our soils contain less than 0.01 per cent. of available phosphoric acid, which means about 300 lb. per acre foot, whereas the soils in South Africa, showing disease, have only .001 per cent. or 30 lb. per acre foot. For years very full analyses of grasses, fodders, &c., have been carried out in our agricultural laboratory, and only in a very few cases such low amounts of phosphoric acid have been found in the samples as are recorded in South Africa.

Sheep Affected by Malnutrition.

Sheep will be affected by malnutrition in a similar manner, although the outward symptoms are rarely so pronounced as with cattle. Bone chewing, and more frequently licking up of earth, are noticed; an excessive liking for salt is also an indication of depraved appetite. The fact of sheep licking certain soil does not indicate that such soil would make a good lick, as many a correspondent to this Department has asserted. The far-reaching results of malnutrition are shown by stunted growths, loss of fecundity, poor percentage of lambing, great mortality among young lambs, greater liability to suffer from worms, and attack by blow flies. Of course all these symptoms become more pronounced during periods of drought. A large number of pastoralists tried to save their sheep from starvation by giving them salt licks, and in many cases where the drinking water was also saline, actually killed the sheep through salt poisoning. The actual amount of salt required by sheep is extremely small, only about 4 to 5 lb. of salt are required per annum, and this quantity is generally fully supplied in the pasture grass, and drinking water. The other mineral constituents, lime and phosphoric acid necessary for the maintenance of an adult sheep, are generally supplied by good natural pasturage, but in the case of ewes the requirements increase rapidly during pregnancy and remains high during the lactating period, so that the amounts supplied by pasturage are in a great number of places not sufficient to cover the demand. The requirements of a young growing lamb are equally high, and from two to three times greater than those of an adult sheep.

The actual amounts of lime and phosphoric acid removed from the soil by wool and sheep are very small, amounting to a few ounces per acre annually; even with fairly heavy stocking of, say, one sheep to 2½ acres, the amount of lime phosphate removed would be approximately only 1 lb. per acre per annum; so that, with an average amount of one-hundredth of a per cent. of available phosphoric acid in a soil, the supply would last many hundred years. Unfortunately, the situation is not quite as favourable as it appears at first sight. Stock naturally prefer the best and most succulent fodders and remain in such localities, and as a consequence the best and most nutritious grasses are eaten out continually and are likely to disappear and be replaced by coarse, poor varieties. As previously pointed out, amounts of mineral constituents must be available in large excess, both for vegetable and animal growth.

Analyses of Soil.

Mr. J. E. Thomas, when making his investigation on the feeding of sheep under drought condition, drew particular attention to the great difference between the pebbly and rolling downs in Central Queensland with regard to nutritive value and palatability of the grasses. The pebbly downs always show a much higher lambing percentage, better growth and yield of wool. These facts were explained by analyses of the soils made in our laboratory. The physical condition of the pebbly downs soil was much better than that of the clayey downs, showing much better capillarity. Humus and nitrogen contents of both soils were rather low, lime plentiful both total and available amounts, the amount of available phosphoric .0195 per cent. in pebbly downs soil against .0014 per cent. in clayey down soil, which is dangerously low. The actual amount of feed grown in good seasons is much larger on the rolling downs soil, but the fodder is not so well relished as the sparser growth, but more varied and palatable feed of the pebbly downs.

The principal fodder grass in the western country is Mitchell grass, which is the most drought resistant of our grasses, but its nutritive value is generally very much overrated. The quality varies very much according to seasons, as shown by a great number of analyses, but is at its best in its young growth.

Flinders grass requires a better rainfall than Mitchell grass, but is a more nutritious and more palatable grass, even in the drying-off stage.

Blue grasses require a still heavier and more evenly distributed rainfall and are highly nutritious in their earliest stages of growth, but lose their nutrition value very quickly when drying off.

Edible herbs and shrubs are available in most districts, although restricted in the main areas of Central and Northern-West Queensland.

Looking over a short list of analyses of such fodder plants, it will be noted many of them are of high food value. The prickly acacia bush stands out on its own on account of high protein contents, and is therefore greatly relished by stock.

Food Supply in Time of Drought.

The greatest problem facing the stockowner is the feeding during drought periods. From the previous remarks it is quite evident that the roughage available in such periods is of exceedingly low feeding value, and therefore the problem resolves itself into supplies of proteins, minerals, and roughage itself.

Proteins can be supplied principally in forms of maize and other grains, and prepared concentrated fodders in the form of nuts or cubes, in which mixtures of all sorts of grains, by-products, and milling offals can be utilised with advantage.

Lucerne hay is of great value, being high in protein and minerals, and at the same time is a palatable roughage, but, unfortunately, high cost limits extensive use. The supply of roughage is the most serious problem in drought time, as it is quite impossible to maintain sheep on licks or grains alone.

What could be done with regard to conservation of fodder for roughage, bush hay, and perhaps in some cases fodder crops, chiefly sorghums, are problems of the future. In the meantime the liberal use of phosphatic licks will improve matters, and stock should be allowed to make the best use of poor coarse fodders, this being advantageous to the grazier in good and bad seasons.

Licks Recommended.

The lick at present recommended, and already successfully used in several places, is made by mixing one part of coarse salt (free from large lumps) with two parts finely ground Nauru or Ocean Island phosphate.

Nauru phosphate is an excellent substitute for bonemeal, as it is cheaper and contains a much higher percentage of lime and phosphoric acid than bonemeal. It is just as digestible as bonemeal, being soluble in weak acids on repeated extraction. The reports spread by some interested persons that Nauru phosphate has caused digestive troubles and ulcerated intestines is absolutely without foundation. Professors McCollum, Hart, and Fuller proved nearly twenty years ago that pigs could be equally well supplied with the necessary phosphorus in the form of inorganic phosphorus compounds, such as precipitated calcium phosphate, mineral phosphates, &c., as in the form of organic phosphorus compounds such as those found in bran, &c. (Research Bulletin No. 1 of the Agricultural Experiment Station, of the University Wisconsin, June, 1909.)

The use of phosphatic licks is of particular importance when feeding on scrub, as practically all our western scrub trees contain in the ash of their leaves a very large amount of lime and very little phosphoric acid. Any large excess of lime accentuates the want and deficiency of phosphorus.

When feeding very dry, coarse roughage, the addition of small amounts of Epsom salts, about 10 lb. to every 100 lb. of lick, is advisable. In very rare cases the addition of about 3 to 5 per cent. of flowers of sulphur, and/or 2 to 3 per cent. of iron sulphate (green vitriol) may have a beneficial effect.

Quantity of Licks to be Supplied.

It is of importance that the stockowner has a rough idea how much lick the animals actually consume; a lamb or a wether should get about 2 oz. of phosphate, or 3 oz. of the mixed lick per week; a ewe with lamb can get up to 6 oz. of phosphate per week. As the Nauru phosphate has neither taste nor odour, the animals in some cases do not take readily to the lick, and in such cases sprinkling the lick with a little molasses, or adding about 5 to 10 per cent. of linseed meal, or any other meal to the lick will induce the animals to eat the lick more readily. The addition of these materials is discontinued or reduced when a sufficient amount of lick is consumed. An extra amount of phosphate will not hurt the sheep, but an increased amount of salt may do serious harm. Keep a supply of lick going the whole year round, so that the animals can get it any time they want it.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF OCTOBER, 1928, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1928 AND 1927, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Oct.	No. of Years' Records.	Oct., 1928.	Oct., 1927.		Oct.	No. of Years' Records.	Oct., 1928.	Oct., 1927.
North Coast.	In.		In.	In.	*South Coast*—continued:	In.		In.	In.
Atherton	0·88	27	0·07	0·59	Nambour	2·98	32	0·72	4·37
Cairns	1·84	46	0·05	1·72	Nanango	2·30	46	1·26	3·38
Cardwell	1·95	56	0·13	2·11	Rockhampton ...	1·80	41	1·26	2·19
Cooktown	1·03	52	0	0·10	Woodford ...	2·50	41	0·78	2·55
Herberton	0·89	41	0·04	0·86					
Ingham	1·55	36	0	1·66					
Innisfail	2·89	47	0·08	3·35	*Darling Downs.*				
Mossman	2·83	15	0·34	4·22					
Townsville	1·24	57	0·62	0·45	Dalby	2·04	58	1·07	2·66
					Emu Vale ...	2·18	32	1·60	4·50
Central Coast.					Jimbour	1·88	40	2·25	2·87
					Miles	2·00	43	0·27	2·83
Ayr	0·97	41	0	0·19	Stanthorpe ...	2·55	55	1·83	2·62
Bowen	1·05	57	0·04	0·90	Toowoomba ...	2·56	56	1·85	3·16
Charters Towers ...	0·67	46	0·19	0·35	Warwick	2·28	63	1·55	2·99
Mackay	1·78	57	0	1·98					
Proserpine	1·80	25	2·09	3·25					
St. Lawrence ...	1·77	57	3·21	3·01	*Maranoa.*				
South Coast.					Roma	1·77	54	0	2·99
Biggenden	2·29	29	0·49	3·41					
Bundaberg	2·01	45	0·45	3·01	*State Farms, &c.*				
Brisbane	2·56	77	1·30	7·15					
Caboolture	2·50	41	1·44	2·55	Bungeworgorai ...	1·47	14	0·25	2·12
Childers	2·46	33	0·27	4·86	Gatton College ...	2·04	29	1·39	2·84
Crohamhurst ...	3·33	35	1·53	5·74	Gindie	1·40	29	...	2·32
Esk	2·47	41	1·79	6·68	Hermitage ...	1·90	22	1·26	3·46
Gayndah	2·37	57	0·44	4·19	Kairi	1·01	14	0·28	0·70
Gympie	2·69	58	2·25	4·54	Sugar Experiment Station, Mackay	1·54	31	0	1·86
Kilkivan	2·59	49	3·14	5·09					
Maryborough ...	2·68	56	0·48	7·05	Warren	2·02	14	0·47	2·58

NOTE.—The averages have been compiled from official data during the periods indicated; but the totals for October this year, and for the same period of 1927, having been compiled from telegraphic reports, are subject to revision.

GEORGE G. BOND, Divisional Meteorologist.

QUEENSLAND RAIN-FOREST TREES

By W. D. FRANCIS, Assistant Government Botanist.

Oliver's Sassafras (*Cinnamomum Oliveri*) is illustrated by the accompanying pictures. It is a large tree, attaining a height of about 130 feet. The bark is brown or dark brown in colour and is rough with hard, pustular processes, especially on large trees. The bark is also strongly fragrant, the odour resembling that of sassafras. The wood is pale or yellowish when green; when seasoned it is pale brown. The sassafras-like fragrance persists in the wood even when it is aged. The wood is very suitable for indoor work, such as lining and cabinet-making. The trees are found in the rain forests from Port Macquarie in New South Wales (R. T. Baker) to Eungella Range (west of Mackay), Queensland.

Photo: W. D. Francis.

PLATE 168.—OLIVER'S SASSAFRAS (*Cinnamomum Oliveri*).

A large tree in the rain forest to the east of Traveston. The peculiar pustular bark is shown in the picture.

PLATE 169.—HERBARIUM SPECIMENS OF OLIVER'S SASSAFRAS.

A shows a dry fruit partly detached from the cup-shaped perianth tube which surrounds the fruit at base. The minute pustular marks on each side of the midrib of the leaves on the left represent scale insects. A flowering specimen is shown on right.

INKWEED ERADICATION.

By N. A. R. POLLOCK, Northern Instructor in Agriculture.

Experiments Conducted.

The greatest trouble that settlers experience in many of the heavy scrub areas of Queensland in grassing land, on which the felled scrub has recently been burnt off, is due to the heavy and persistent growth of Inkwood (*Phytolacca octandra*), which if not destroyed, soon covers the ground and smothers the young grass shortly after the seed has germinated. The most satisfactory and economical method of dealing with the trouble will be found, it is considered, in pulling up the young Inkweed plants as they appear, thus giving the young grass opportunity to become established, after which germination of further Inkweed seed or growth of same after germination will be greatly impeded. By this means a stand of grass is secured the first year, the value of which is apparent.

In certain areas, however, notably in the vicinity of Millaa Millaa, where the rainfall is heavy, the growth of Inkweed, many settlers claim, has been too rapid to allow of extermination by hand pulling or hoeing, causing many areas on which grass seed was sown after the scrub had been felled and burnt off to become so infested that growth of grass was entirely prohibited.

With a view to overcoming this trouble, the Department of Agriculture instituted experiments in control by the application of various poisonous sprays, which were carried out during the present year by Mr. Field Assistant Tarrant, of the Atherton office.

The design of the experiments was as follows:—

1. Roberts' Prickly Pear Poison in strength as supplied.
2. Cooper's Weedicide—1 part to 75 parts water.
3. Cooper's Weedicide—1 part to 50 parts water.
4. Arsenic Pentoxide—½ lb. to 1 gallon water.
5. Aresnic Pentoxide—½ lb. to 1½ gallons water.
6. Arsenical solution—1 lb. arsenic and 2 lb. caustic soda to 25 gallons water.
7. Arsenical solution—2 lb. arsenic and 4 lb. caustic soda to 25 gallons water.
8. 2 lb. ferrous sulphate to 1 gallon water.
9. 1½ lb. ferrous sulphate to 1 gallon water.

The cost of the materials were—

Roberts' Prickly Pear Poison, 3 $\frac{25}{10}$ d. per lb., Wallangarra.

Cooper's Weedicide, 52s. 6d. per 5-gallon drum, Brisbane.

Arsenic Pentoxide, 37s. 4d. per cwt., Brisbane.

Arsenic, 40s. per cwt., Brisbane.

Caustic soda, 40s. per cwt., Brisbane.

Ferrous sulphate, 16s. per cwt., Brisbane.

Roberts' pear poison was applied by a Roberts' pump and atomiser, while the other solutions were applied by a knapsack spray pump. The experiments were conducted on Inkweed of three years' growth and on young Inkweed of about six months' growth. Each plot was designed as one-tenth of an acre, with a width of 12 feet.

Mr. Tarrant reports:—

OLD INKWEED TRIALS.

These were conducted in January at E. Grindle's farm, Moregatta, where the Inkweed was of three years' growth and almost impenetrable. Lines were brushed to facilitate operations and to allow application from each side of the 12 foot strip; each plot took from eighty to ninety minutes to treat, excluding the time required for brushing the lines, which implied a period of two days, approximately to treat an acre. Heavy rains occurred each day during the applications, causing a postponement of Cooper's Weedicide and ferrous sulphate treatments until finer weather prevailed.

Plot (1) Roberts' Pear Poison at full strength.—The plants showed a scorched effect within five minutes of the application, all top growth and roots being dead

PLATE 170.—INKWEED EXPERIMENTS.
P lot treated with Arsenic Solution without effect.

PLATE 171.—YOUNG INKWEED OF UNDER A YEAR'S GROWTH, NOT TREATED.

within three weeks. The poison used was at the rate of 25 gallons, and at a cost of £3 8s. 9d. per acre.

Plot (2) Cooper's Weedicide at 1 part to 75 parts water.—The plants did not show any effect until after three days, when the leaves and small branches were killed; but within three weeks fresh growth was made from the main stems, and several weeks later the plants appeared as vigorous as before the application. The cost of the material was at the rate of 10s. 10d. per acre, with 40 gallons of solution.

Plot (3) Cooper's Weedicide at 1 part to 50 parts water.—The experience here was similar to that in Plot 2, while the cost per acre of the application was 16s. 3d. at the rate of 40 gallons.

Plot (4) Arsenic Pentoxide, ½ lb. to 1 gallon water.—After four days the effect was noted on the foliage, and in five weeks the plants had died down to the ground, but new growth appeared from the roots. The cost of the application was 6s. 8d. per acre at the rate of 40 gallons.

PLATE 172.—SHOWING PLOTS OF INKWEED OF 3 YEARS' GROWTH TREATED IN JANUARY. PHOTO. TAKEN IN JUNE.

Plot in foreground was treated with Roberts' Pear poison which killed the Inkweed. Growth on plot is "Goat Weed." Stump in foreground may be seen in photo. 1 at the top marking end of plot.

Plot (5) Arsenic Pentoxide, ½ lb. to 1½ gallons water.—The experience here was similar to that on Plot 4, except that the action of the spray was much slower. Cost of treatment was 5s. 6d at the rate of 40 gallons per acre.

Plots (6) and (7) Arsenical solutions, and Plots (8) and (9) Ferrous Sulphate solutions.—These applications showed no appreciable effect on the growth.

YOUNG INKWEED TRIALS.

These trials were conducted in May on T. Fraser's farm, Lorenz Creek, where the Inkweed was not of more than six months' growth, and offering no difficulty in applying the treatments. Viewing the effect of the sprays on the older growth in January, an alteration was made in the treatments, in which the results were as follows:—

PLATE 173.—YOUNG INKWEED OF UNDER A YEAR'S GROWTH.

PLATE 174.—INKWEED EXPERIMENTS ON YOUNG INKWEED.

Left.—½lb. Arsenic Pentoxide to 1 gallon water.
Right.—½lb. Arsenic Pentoxide to 1½ gallon water.

Plot (1) Roberts' Pear Poison, full strength.—Within five minutes after treatment the foliage was all scorched, and within ten days all growth and roots were dead. The cost per acre at an application of 20 gallons was 55s.

Plot (2) Roberts' Pear Poison, half strength.—This treatment took several hours to show any effect, but in twelve days all growth and roots were killed. The cost of the application at 20 gallons was 27s. 6d. per acre.

Plot (3) Arsenic Pentoxide at ½ lb. to 1 gallon water.—No effect was shown on the plants until the third day, but in fourteen days all growth and roots were dead. The cost of the application at 30 gallons per acre was 5s.

Plot (4) Arsenic Pentoxide at ½ lb. to 1½ gallons water.—The effect here was as successful as in Plot (3), but much slower. The cost of the application at 30 gallons per acre was 3s. 4d.

Plate 175.—The Effect of Roberts' Prickly-Pear Poison on Young Inkweed.
Full strength to left of board; half strength to right of board.
Dividing line of two plots marked by a line from the board in the foreground and the figure up the hill. Treated in May, photo. taken in June.

Plot (5) Arsenic solution at 2 lb. arsenic and 4 lb. caustic soda to 12 gallons water.—Used at the rate of 30 gallons per acre no effect was noticeable at any time after the application. The time occupied in applying the treatments was at the rate of eight to ten hours per acre.

When the plots were inspected in company with Mr. Tarrant on 10th June it was noted that the plot treated in January with Roberts' Pear Poison, where the old Inkweed had been completely destroyed, showed a heavy growth of Billygoat Weed (*Ageratum conyzoides*). This weed is an annual of late season growth, common to the Tableland, which dies down in the winter and is useful in the maize areas in assisting to burn off the dry cornstalks, an office it may possibly perform to advantage with the dry Inkweed. On old Inkweed, of the applications made, Roberts' Pear Poison, only, appears to be effective, but the cost of £3 8s. 9d. for poison added to that of two days' labour in applying, as well as the brushing of tracks, does not

render it an economical proposition; even if the heavy growth could be killed out at a cheaper rate and burnt off, much the same trouble as on newly felled areas would be faced with the young Inkweed growth when the land was resown with grass seed.

Further trials in heavy Inkweed growth are suggested, in which a gaseous treatment might be more economically effective.

On the young Inkweed growth the cost of the treatment with Arsenic Pentoxide at 5s. 6d. or 6s. 8d. per acre, plus that of labour in applying, is the most reasonable, but it is probably that the treatment would also kill out any grass growth and thus necessitate a reseeding.

Possibly, if the Inkweed were allowed to germinate on the new clearing, and then destroyed by spraying before the grass seed was sown, success might be achieved.

PLATE 176.—ROBERTS' PRICKLY PEAR POISON ON INKWEED OF OVER 3 YEARS' GROWTH.

Plot was a strip 12 feet wide running from the front to the right of tree in the centre to stump on top of the hill. Applied in January. The photo. was taken in June. Inkweed completely killed, but largely hidden by growth of "Goat Weed" which dies off in spring and allows of burning off with the dead Inkweed.

The objective, of course, is to establish grasses on the clearing at the least cost. In the case of young Inkweed, the cost of eradicating by hand must be set against that of spraying perhaps more than once, and also of perhaps reseeding a second time, with subsequent loss of time in getting grasses established. Until further data is obtained in this direction, it would appear that settlers would be well advised to pursue the old method of sowing the grass seed immediately after the burn and eradicating the young Inkweed plants by hand. Should this not be found practicable over the whole area, alternate strips might be given attention which would allow a certain amount of grass to be secured and thus give greater facility for spraying the other strips where the Inkweed had taken possession.

GINGER GROWING IN QUEENSLAND.

By A. E. GIBSON, Senior Instructor in Agriculture.

A good deal of attention has lately been drawn to the cultivation of ginger as a crop which is suited to the soils and climate of Queensland, but it must be remembered that the consumption of ginger within the Commonwealth is comparatively small, but by means of an advertising campaign it could possibly be increased by double the quantity that is imported and consumed at the present time. At the same time, care must be taken to prevent over-production of the locally-grown article.

As regards the importations of ginger in all forms, for the period ending 30th June, 1928, a total of 672½ tons of ginger was imported to the Commonwealth from overseas, chiefly from China. This includes green, dry, and partially and wholly preserved ginger which could be produced in Queensland by the cultivation of approximately 200 acres of land—hence the need of caution is reiterated in regard to ginger production.

Unless the local grower is prepared to accept a price which is in accord with that at which the article can be imported, there appears to be very little hope of replacing the imported article by that produced locally.

Plate 177.—A Heavy Crop of Ginger on the Slopes of Buderim Mountain.

A visit was recently paid to Buderim Mountain to ascertain what progress was being made in the industry, and it would appear that there is at present a "boom" in the ginger growing industry. An article on ginger growing at Buderim which was published recently may be largely responsible for this. The article in question stated that "although the markets may fluctuate slightly, growers may expect to receive an average price of approximately £56 per ton." This price is, of course, for large quantities, 9d. per lb. being obtainable for small lots. It may interest growers to learn that green ginger is imported into the Commonwealth and landed at Melbourne at a cost of £32 13s. 4d. per ton c.i.f., or 3½d. per lb. Semi-preserved ginger in syrup is landed in Brisbane at £40 per ton c.i.f., and in regard to this class of ginger it may be stated that in a 2 cwt. cask of partly preserved ginger, not more than 20 lb. would be represented by syrup, and this of a heavy density. Intending growers should consider the position before taking definite steps in the matter.

Ginger growing has occupied the attention of the residents of Buderim Mountain and surrounding districts for many years, and it is known that a present resident of Buderim successfully grew ginger forty years ago. Perhaps one of the most experienced growers at present in that district is Mr. A. J. Burnett, who has been

growing ginger for the past twenty years. This gentleman's property is situated on the western slopes of Buderim Mountain, at Glenmount, and he has approximately an acre under ginger. The soil is a medium clay loam, and is distinct from the typical red volcanic soil usually associated with Buderim Mountain. Ginger, when properly cultivated and fertilised with heavy applications of bone dust, can be produced on the slopes of Buderim Mountain of a quality superior to the ginger imported from China, and with the advantage of being fresher than the imported article. Mr. Burnett states that he has produced up to 5 tons per acre, and that 4 tons is regarded as an ordinary yield under favourable conditions. His practice is to prepare the area well ahead of planting, which should take place in October. The ginger is planted in drills (previously fertilised) spaced 2 feet apart with 9 inches between the sets which are planted at a depth of 3 inches. Plant ginger, which shows signs of growth, or as it is termed "shot" ginger, is preferred for planting purposes. Immediately following on the planting, a heavy mulch of grass is applied to the whole of the area, but not just immediately over the sets. Thus the appearance of a newly planted area is practically a mat of grass to the depth of 2 to 3 inches. It requires approximately 1 ton of plant ginger to plant an acre on the lines advocated.

The object of the mulch is threefold—(*a*) It retains moisture in the soil, (*b*) it retards and keeps down weed growths, and (*c*) it gives an added pungency to the ginger.

Little or no weed growth will appear if the initial preparation of the soil has been thorough, and any such growth can be easily and readily handled.

Green ginger which is required for confectionery purposes needs to be harvested at an earlier period than that which is utilised for drying—jam and chutney and other manufactures—and when harvested for this purpose the yield obtained is only about half that produced when the rhizomes are allowed to mature.

Young ginger is both tender and free from fibre, which is objectionable for preserving purposes.

Ginger intended for plant purposes can be left in the soil until the approach of the planting season, and will then be in a better condition for planting.

Harvesting of matured ginger takes place subsequent to the flowering period and when the tops have dried off. For the lesser matured article it is necessary to lift the crop well ahead of this period, usually in April, when the first flowers put in their appearance. An examination of the hands and rhizomes to ascertain the state of maturity, however, must be the true guide.

Owing to the need for care in lifting the crop the whole operation is one which can only be carried out satisfactorily by hand. This, of course, tends to add to the cost of production, but is at present—and until some machine is perfected which will do the work satisfactorily—unavoidable.

As an adjunct to fruitgrowing and other industries in those districts which have a soil and climate suited for ginger growing, the crop has much to commend it, and provided that growers, as a body, will co-operate with the object of maintaining a high standard of ginger, there should be no reason (when the supply equals the demand) for importations to continue.

The need of caution in the future to prevent over-production, however—as Queensland cannot hope to compete in an export trade—is imperative.

THE DAIRY HEIFER.

The dairy heifer is a unit of the potential milking herd. The breeder who knows how to grow and handle dairy heifers will add substantially to his achievement with his dairy herd.

The demand for reproduction and milk production are so heavy on high-producing dairy females that every opportunity must be given for growth and development before the animal begins her lactation period.

Improper feeding and breeding at too early an age are two factors to avoid.

The time to take advantage of the growth impulse is when it is most potent, and when demands for milk production do not interfere with its influence.

Do not allow the dairy heifer to get a setback by turning on to scant pasturage or by improper feeding.—C. F. McGRATH, Supervisor of Dairying.

THE CONSTRUCTION OF MOTOR TYRES.

ENSURING GOOD SERVICE AND DURABILITY.

By RADIATOR.*

Fabric or canvas consists of interlaced cotton strands known as warp and weft; the warp being the longitudinal strands, and the weft the cross strands. When fabric is used as the base for a motor tyre, considerable friction is caused in these interlaced cotton strands.

Consider a tyre rotating as the car moves. The portion of the tyre touching the ground is slightly flattened. This flat portion keeps on moving around the tyre as the wheel rotates. The result is that every portion of the circumference is pressed in slightly and allowed to expand again once for each revolution of the wheel. The degree to which the tyre is inflated, of course, affects the exent by which the tyre is flattened; naturally balloon tyres are flattened much more than high-pressure tyres. This constant flexing of the tyres naturally causes internal friction in the tyre.

In the case of the fabric tyre the constant flexing causes the interlaced strands to rub the one against the other, and as well as generating a lot of heat by friction, the strands also chafe. The heat generated causes the rubber to over-vulcanise and so become rotten. On account of these defects the fabric tyre is only suited for high pressures where the amount of flexing is extremely small.

The cord tyre overcomes the defects of the fabric tyre as follows:—There being only longitudinal cords in each ply, the friction between interlaced strands is entirely removed. Also the cord tyre provides a ready means of surrounding each cord with rubber which takes up the flexing without generating any heat or any chafing.

The comparison between the two tyres will be better understood when the construction of the tyres has been explained.

After the cotton cords have been cleaned at the tyre factory, they are impregnated with the very best of rubber; this means that each cord is surrounded with a film of rubber that will act as a cushion when the tyre is flexed. The process of impregnating the cords is known as "proofing."

In the case of fabric, the material is spread with a coating of rubber, but it is obviously difficult to separate each strand from its neighbour in the fabric.

The tread is always of hard rubber, and is placed on the tyre in various ways by different manufacturers. Sometimes the tread is extruded complete in one piece, and placed upon the tyre, whereas other treads are made up in layers. The tread is arranged so that the periphery has the thickest rubber, while the edges taper away to nothing.

In the single cord process, the whole tyre (including the tread) is vulcanised together. This method produces a satisfactory tyre, but the objection is that any flaw in the vulcanising of the casing will be undetected.

In the double cord process the casing is vulcanised in one operation, and the tread is vulcanised on in the second operation.

The vulcanising takes place in a metal mould. It is in this process that the various designs of tread are imprinted on the outside. While in the mould the whole tyre is heated with steam and at the same time subjected to an enormous hydraulic pressure (about 2,000 lb. to the square inch). This vulcanising process causes the whole tyre to weld together into one mass, and if the vulcanising has been a thorough success there should be no blisters in the rubber.

This description of the manufacture of tyres will probably explain to the reader why tyres are so expensive. Although the making of tyres is a scientific process, the reader must not think that good tyres cannot be made in Australia. Good tyres have, and are, being made in Australian factories. The raw material is, of course, imported, but it is hoped that in the near future Queensland will provide the necessary cotton at least.

The development of tyres has probably contributed most, in the last fifteen years, to the progress of motoring. In 1913 it was quite possible to procure a reliable car, but the tyres of that time were certainly a worry. Punctures and blow-outs were extremely numerous, and the motorist who made a 200 mile trip without tyre trouble was more fortunate than the one to-day who does 2,000 miles without trouble.

*In the "Farmer and Settler."

To conclude this article a few words about the preservation of tyres will probably be in season. The following points should always be adhered to:—

(1) Keep the tyres inflated to the correct pressure; an air pressure gauge is an essential accessory.

(2) Never run on a flat tyre, even for a short distance. It is far better to remove the tyre and run on the bare rim.

(3) Keep the tyres and tubes free from grease and oil, as these two destroy rubber.

(4) Make sure that the wheels are always correctly aligned. To run a car with the front wheels badly out of alignment will mean that the tyres will be ruined in a hundred miles. Even a little inaccuracy in alignment greatly shortens the life of the tyres.

(5) Always keep the brakes equally adjusted and capable of being easily applied.

(6) Drive carefully. This last item is the most important of all. Never accelerate or brake suddenly, do not skid around corners, and never take a corner more sharply than necessary. Do not race uphill in gear. Every time that the wheels bounce off the ground they race and tear off a piece of rubber as soon as they again touch the ground.

If the tyres are well cared for, and the car carefully driven, the tyre life will be double that obtained if the tyres are not considered. Having regard to the price of tyres, the care is well worth while.

BREEDING AND SELECTION OF DAIRY STOCK.

By C. F. McGRATH, Supervisor of Dairying.

The industry needs better cows, and the dairy farmers and breeders must breed and rear the better cows, because they do not now exist to the extent required.

The foundation of the dairying industry for the future must be laid now in the breeding and rearing of high-class dairy stock.

That this work can be done with the degree of success its importance demands is evidenced by the success attained by many breeders of high-class dairy stock in this and other States of the Commonwealth.

Breeds of dairy cattle have been in existence for many years past, but the stud master of to-day breeds on dairy lines by selecting and mating animals whose parentage have high production records.

Pedigrees alone do not indicate the quality of milk and butter fat that a cow will produce. Such characteristics are the animal's heritage, and by careful dairying Nature's gift to her can be developed to its full capacity.

A successful stud master knows that a certificate of registry in a herd book is not evidence of high dairy production, and he realises that selection is not confined to pedigree. Attention is given to the constitution, production, conformation, and general characteristics of the animals selected from which to breed.

It is important that the constitution be sound, and this is indicated by large, well-developed lungs and a broad and deep chest. A sound state of digestive organs is important and has a great influence on all the functions of the body, and more especially on the secretion of milk.

Dairy type and conformation are readily discernible by the trained eye of the stock breeder. An animal of the desired type and character attracts and fills his eye and is then subjected to a close examination for the points and characteristics essential in good dairy animals.

A knowledge of the development of dairy qualities in cattle is a valuable aid in the selection and breeding of dairy stock.

The development of dairy qualities in the female begins by exciting the udder to unnatural activity by stripping it at frequent and regular intervals of all the milk secreted.

Care in handling and proper feeding are essential to produce high-quality dairy animals, and if supplemented with a sound knowledge of selection and breeding the desired characteristics will be transmitted to the offspring.

Such prepotency is to be obtained by line dairy-breeding rather than by simply breed breeding.

Breeding.

A great deal has been written on breeding, and many breeders have contributed to the literature on the subject and quote pedigrees and discuss high-class animals that have been inbred. Such results invariably reflect the intelligence of an experienced stud master.

Disastrous results have invariably followed inbreeding of dairy stock when practised by the inexperienced stock breeder, as is evidenced by the numbers of nondescript animals to be seen in many districts.

There are several methods of breeding, as practised by stud masters—viz., inbreeding, line breeding within distinct families, line breeding with distant strains of the same blood, and outcrossing, which is the continued introduction of fresh blood.

Inbreeding is the practice of mating closely related animals such as sire to daughter, son to dam, brother to sister.

It is considered that an animal is inbred when its parents have 50 per cent. or more of common ancestry in the pedigree.

The purpose of inbreeding is to fix or intensify desirable characteristics or qualities in animals so that they will more consistently transmit such characters to their offspring.

Many high-class flocks of sheep, herds of cattle, and breeds of horses have been established by inbreeding.

Such successes have been achieved by stock breeders who possessed an intimate knowledge of the breeding and general characteristics of the animals mated, a natural aptitude for their work, and the gift of observing the good and bad points of the selected animals.

The problem confronting the stud breeders is to choose animals that possess outstanding desired characters and to eliminate from the breeding operations those animals which possess undesirable characters. Skilful selection of the animals to be mated is the all-important factor in purifying the hereditary make-up of the individual in a herd, and for intensifying type and breed characteristics that will ensure that the offspring will inherit the character of the parents, to a degree equal to or better than their parents.

Line Breeding.

Line breeding may be differentiated from inbreeding as defining it as the mating of two animals identical to the extent of 25 per cent. and less than 50 per cent. of their blood. Line breeding is a popular practice with breeders, as it is not accompanied with so great a risk of reproducing and fixing undesirable characters as is associated with inbreeding.

Line breeding within proved strains of blood is a safe method for breeders desirous of improving their herds. The system widens the opportunities of selecting animals with desired characteristics.

Out Crossing.

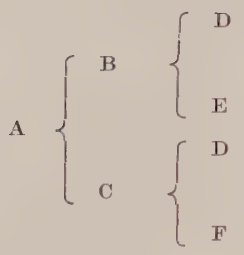
Outcrossing is the mixing of strains of blood within one breed by mating animals entirely unrelated or having less than 25 per cent. of common ancestry entailing a continuous change of blood.

This method of breeding is frequently disappointing unless controlled by an experienced breeder. Ability to select sires with the characteristics necessary to maintain or improve the standard of the herd to which he is mated is essential, otherwise the more fresh blood that is introduced the more uneven in character will the herd become, though a few high-class animals may be bred.

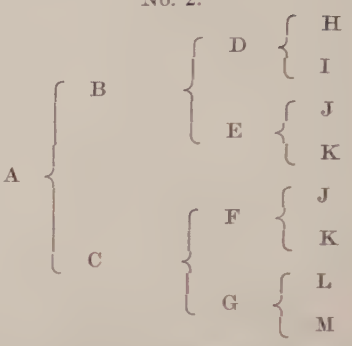
A study of Mendel's laws of heredity will enable the breeder to readily understand why the outcrossing method is often unsuccessful and misleading to the young and inexperienced breeder of live stock. The pedigrees tabulated below clearly indicate the difference in the methods of breeding.

INBREEDING.

No. 1.



No. 2.

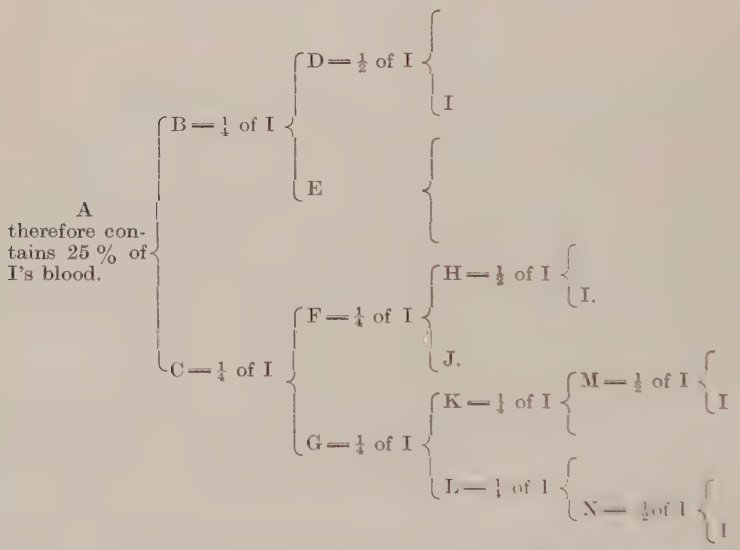


No. 1 tabulation indicates that A is inbred as son and daughter of sire D are mated.

No. 2 tabulated example indicates that E the dam of B (sire) and F the sire of C are full brother and sister, so that B and C the sire and dam of A are first cousins in blood.

LINE BREEDING.

No. 3.



No. 3 tabulation indicates that A has been line bred to dam I. The dam G having two lines of blood to I has been mated with F, whose sire H is a son of I, and the progeny C has been bred to the sire B who is a grandson of I.

In this case line breeding with distant strains of the blood of dam I has been carried out, and there has been sufficient latitude to allow faults to be eliminated and desired characteristics to be fixed by selection.

By this method desired individual characteristics of animals can be retained or intensified in the progeny.

The breeder should make up his mind as to the breed he considers most suitable and which he desires to establish, and then select the foundation stock from breeders whose stock come nearest to his ideal.

A keen observation of the animals he is breeding will enable him to cull his herd and select sires to fix type and character which are essential to success. Sound judgment in selection and mating and judicious feeding are necessary in the successful establishment of a profitable dairy herd.

THE GROS MICHEL BANANA IN NORTH QUEENSLAND.

W. J. ROSS, Assistant Instructor in Fruit Culture.

Notwithstanding the Gros Michel banana (known also as the "Fijian," "Jamaican," &c.) has been grown in a limited way for a number of years in North Queensland, there are many people who are not acquainted with its characteristics and excellent qualities, much less its requirements from the cultural standpoint. Tests conducted some time ago and followed by observation extending over a long period have established its value as a commercial fruit, and also the suitability of many localities in different parts of the North for its successful cultivation. Its claim for attention, as regards the growing of it on a much greater scale than hitherto, is now being recognised as evidenced by the number of applications for plants received by those in the position to supply.

Plate 178.—Fine Hand of Gros Michel Bananas, showing Length of Fruit.

The intention of this article is to submit to the readers of the Journal a few observations, together with illustrations, which might be of interest if not of useful guidance to those contemplating entry into this branch of fruit production.

Characteristics.

Conspicuous among its characteristics when compared with the Cavendish variety are:—Its tall growing habit, often attaining a height of 30 feet from the ground to the tip of the uppermost leaves; strong growth, having stems 4 feet and more in circumference at the base; open structure of the bunches, affording more room for the development of the fingers or individual fruits which are usually very large and less curved than the Cavendish; and, lastly, what may be regarded as its most desirable characteristic, the thickness and toughness of the skin of the fruit which renders it capable of withstanding to a greater degree the ordeal of reaching distant markets in a more saleable condition than is the case with Cavendish.

Importation of Plants from Fiji.

It was this variety that popularised the trade between Fiji and Australia in the past, to the detriment of our Northern industry, which was almost wholly confined to the growing of the Cavendish variety. In order to frustrate as far as possible the increasing popularity of the Fijian banana on the Southern markets in those days, the Mourilyan Syndicate and also the Department of Agriculture and Stock imported into this State, during the years 1909 to 1912, a quantity of Gros Michel plants which were to be the foundation stock from whence supplies of plants could be distributed as required. A propagating area was established at the Kamerunga State Nursery (long since closed), and from this institution plants

PLATE 179.—PORTION OF PLANTATION OF GROS MICHEL BANANAS, 12 MONTHS AFTER PLANTING.

were sent long distances. The accompanying illustrations, taken quite recently on Mr. P. Monaghan's plantation at Kennedy, depict the progeny of the original imported plants, some of which were sent to the Cardwell district.

"Panama Disease."

It is generally recorded that the Gros Michel is subject to attack by what is called "Panama Disease" (*Fusarium cubense*), a very serious malady in countries where this variety is extensively grown; but it is noteworthy that during the time this banana has been grown in parts of North Queensland, continuously since 1910,

no serious symptoms of disease other than those associated with Cavendish have been recorded. On Mr. Monaghan's property, as well as in other plantations in the Cardwell district where this variety is grown, there are no apparent indications of the presence of "Panama."

Limitation of Growth.

It may be asked, why this banana was not more freely grown by the Chinese growers in the north years ago. The answer is, firstly, that it was not until it was too late to stop the decline of the Northern industry, that importations of plants were made. Secondly, the expansion of the sugar industry and the keen competition for the class of land which was favoured by the Chinese for the growing of bananas were then taking place. Further, the amended Land Act, restricting the ownership

Plate 180.—Gros Michel Bananas, showing Height at which Bunches are Borne.

of land to not more than 5 acres in the cases of unnaturalised Chinese—together with the growing popularity of Fijian fruit on the Southern markets and consequent poor returns to Northern growers—assisted to deter the opening up of new plantations in areas not immediately required for sugar and where facilities for transport were available. Again, the Cavendish or Chinese banana, as it is sometimes called, had in the latter sense of the term, an attraction for Chinamen, Chinese growers were disinclined to change over from the growing of the Cavendish variety.

The reason why it is not grown in the Southern districts is due to the fact that it requires a tropical climate and well-sheltered locations. It would be slower to grow and mature its fruit than the Cavendish if grown in Southern districts where the latter succeed.

Directions for Planting.

When planted in congenial locations fruit from the Gros Michel are ready for market in from twelve to thirteen months after planting. The plants should not be set out any closer than 15 feet apart each way. Select a well-sheltered location, preferably flat land rich in humus, for the plantation. Basin flats with high surrounding banks, such as are found contiguous to rivers and creeks, are ideal if not subjected to too severe flooding. Shelter afforded by ranges of hills, or by leaving heavy belts of scrub surrounding the area to be planted is also to be considered.

Choose club-shaped plants, i.e., those tapering to a sharp point at the apex and having large butts. The depth at which plants are placed in the ground is governed by the size of the plants used; but if allowance is made when digging holes to admit of there being a basin from 4 to 6 inches deep left around the plant after the corm has been covered by 3 or 4 inches of soil, the operation will have been satisfactorily performed. The basin left around the plant will fill in during the course of later cultivation, which consists mainly in suppressing weed growth and retaining a good soil mulch to aid conservation of moisture.

On account of the height at which the bunches of the Gros Michel are borne, some difficulty might be experienced at the time of harvesting. The method usually practised is to make a V-shaped cut about three parts through the stem of the plant and on the same side as the bunch is hanging. The head of the plant with the bunch gradually falls over, and it may be further steadied by placing a forked stick under the stem and lowering as required until the bunch can be handled and severed from the plant. The bunches are then treated with the utmost care, while all subsequent operations such as dehanding, sweating, grading, and packing are carried out in as careful and thorough manner as possible.

WEEDS OF QUEENSLAND.

By C. T. WHITE, Government Botanist.

BUTTON WEED OR BUTTON MALLOW (*Modiola caroliniana*).

Description.—A weed of one or several years' duration, the stems freely branched and procumbent or more or less ascending, 6-18 inches long, stems and leaves covered with scattered hairs. Leaves orbicular in outline but much cut and divided, mostly about 1-1½ inches across, on slender stalks of up to 2½ inches in the lower leaves. Flowers solitary in the leaf axils, on slender stalks of about the same length or longer than the leaf-stalks; spreading flat, about ½ inch across. Petals 5, red. Fruits composed of about 20 carpels, the carpels blackish when ripe and clothed on the back in the upper part with rather long bristly hairs.

Distribution.—A native of Central America, the West Indies, and the warmer parts of South America and the United States, now widely spread in other parts of the world as a naturalised weed.

Common Names.—Button Weed, Button Mallow, Red Mallow, Bristly-fruited Mallow, and Creeping Mallow are names variously applied to it.

Botanical Name.—Modiola from Latin Modiolus (dim. of modius, Gr. modius) the Roman corn measure, the fruit shaped like a bushel measure; caroliniana, a native of Carolina, U.S.A.

Properties.—Like other members of the Mallow family it no doubt has some value as a fodder.

Eradication.—The plant is not a particularly aggressive weed in Queensland. Cutting off well below the surface of the ground is sufficient. If any part of the crown is left it shoots up numerous strong wiry stems.

Botanical Reference.—*Modiola caroliniana* (L.) G. Don. Gen. Hist., Pl. 1, 466, 1831. *Modiola multifida* Moench. Melh. 620.

PLATE 181.—BUTTON WEED (*Modio'a caroliniana*).

A. Plant about half natural size.
B. Single flower (face view).
C. Single flower (back view).
D. Ripe carpel containing seeds.

PIG TRANSPORT.

E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

The transport of stud pigs by horse-drawn or motor vehicle or by rail or steamer requires that they be comfortably accommodated in roomy crates, provided with ready means of entrance and exit and with a convenient food trough. The accompanying illustration serves to convey to the reader the care exercised and the provision made by Queensland State Farms and other Government institutions in the crating of stud pigs for transport purposes to all parts of the State.

The excellent condition on arrival that is frequently specially mentioned by purchasers of stock from these farms, and the absence of any loss in transit is a testimony in itself to the methods adopted. It will be noted that large airy crates are built, fitted with sliding entrance door and roomy feed trough; the crate is covered with sound bagging protection for tropical conditions—a special feature where stock have often to remain in the open at wayside stations or be conveyed to the farm some miles distant.

It will also be noted that the crates are suitably stencilled with the particulars of the stock and the breeder's name and address, thus presenting a neat and attractive consignment which in itself cannot fail to attract attention.

PLATE 182 (Fig 1).—A STACK OF PIG CRATES READY FOR DESPATCH.

Attention to all matters of detail counts much for success in matters associated with the breeding and sale of stud stock. The successful men are the ones to whom all this detail is a pleasure as well as a business. Nothing pleases a buyer more than to have his purchases arrive in an attractive condition, for the arrival of fresh stud stock invariably creates considerable interest among the farming community. The farmer who receives a stud boar or sow in good order and condition in a neat, attractive, stencilled crate, and who can take the pig's pedigree from his pocket-book and exhibit it for the benefit of his neighbours, is certainly doing not only himself but his district a good turn, for much depends upon the success of such purchases. If they are a success good business results; if they are a failure the stud pig business receives a rather hard bump.

It is up to breeders, therefore, to see to it that their stud stock go out to buyers in convenient, roomy utility crates—crates that can be made use of for other purposes than for the mere transport of pigs from station to station or from farm to farm.

Full details as to the size of crates, their approximate cost, &c., can be supplied on application to the Department of Agriculture and Stock, Brisbane.

Speedy Return of Crates.

Breeders should pay strict attention to the immediate return to vendors of crates used in the transport of breeding stock, for, unless this matter receives immediate attention, vendors are placed at a considerable disadvantage and are compelled to have a larger supply of crates than would be necessary if their crates were returned immediately after use.

To the breeder despatching only one or two pigs each month or quarter, this may not appear to be an important item, but to the breeders of stud stock, who carry on business on a large scale, it is an exceedingly urgent matter and one that should not be lost sight of in these transactions.

As the stud pig business is developing rapidly and as more stud pigs are now being handled than ever before, the crate problem becomes a more important one and one which causes many breeders great concern. If it cannot be arranged that the crates be returned immediately, purchasers should inform vendors by letter so that they will not be making unnecessary journeys to the local railing station in search of returned crates.

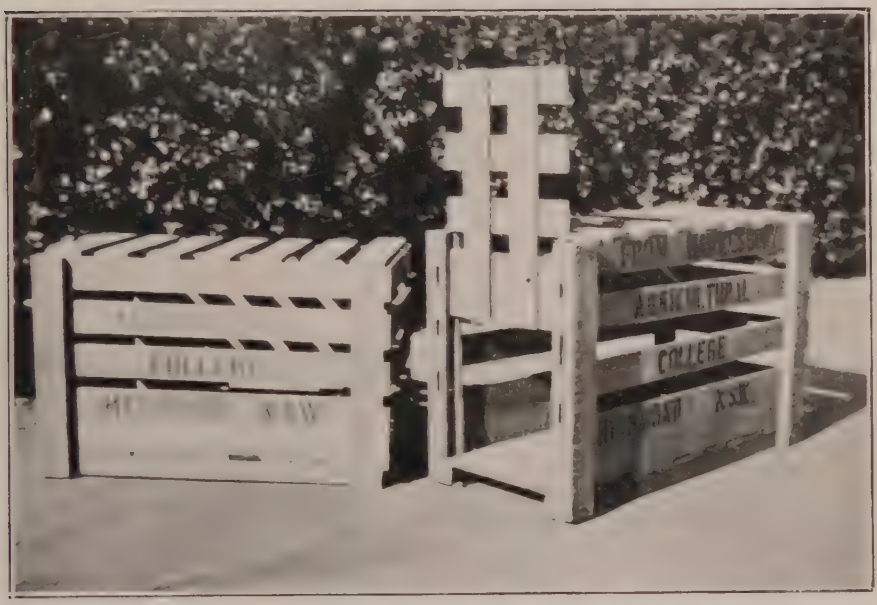


Plate 183 (Fig. 2).—The Type of Pig Crate recommended for use in the Transport of Pigs per Rail, Road, or Steamer.

Note style of door and attractive stencil of breeder's name and address. The trough does not show in this illustration.

Bacon factories, which receive a few pigs in crates, are always prompt in attending to the return of the "empties," otherwise their business would be checked.

It is equally urgent that, when purchasers do return crates, they should inform vendors by letter, so they will be on the lookout for the crates. It is worthy of consideration that sales of stud pigs should be on a basis of delivery in crate on rail, free of all charges at purchaser's station. Such a system would save endless worry and annoyance. In actual practice, it is quite possible and satisfactory.

Crates Should be Kept Clean.

Stud pig-breeders should be careful to thoroughly disinfect crates prior to despatch of stud pigs, and to be especially careful to redisinfect them again on arrival at the home farm. This is necessary by reason of the fact that hog lice, the most prolific and persistent of the external parasites of the pig, breed not

only on the pig's body, but also in cracks and crevices in the sties, roofing and partitions, as well as in pig crates, especially those that have been used for the conveyance of pigs that were infested with these parasites.

Complaints have been made on several occasions of specially selected stud pigs arriving at their destination "smothered in lice." Nothing is more disgusting to the purchaser and the enthusiastic beginners in the business than to receive specially selected valuable animals in such a condition. In fact, it gives the breeder a considerable set back, and, incidentally, paves the way for the introduction on to what is probably a clean farm of a host of parasites, which rapidly accommodate themselves and, in the course of a few hours, are breeding and thus increase their numbers. Frequently when the animals left the vendor's farm they were crated and guaranteed free from lice, though the vendors quite forgot to examine the old empty crates, which were used in despatching stud pigs. Such carelessness causes a great deal of harm to the vendor as well as to the industry as a whole.

Food Troughs in Pig Crates.

It is absolutely essential that breeders should provide a suitable food trough in all crates used for the transport of pigs by rail, road, or steamer. The food trough should be constructed so that it is capable of being used also as a water-trough. It is a decided advantage, too, where railway regulations permit, to provide some form of bedding in the crate, even if it is only clean, dry sawdust or moist sand. It will be argued, of course, that the latter would considerably increase the weight of the consignment, but generally the freight charges on crates are rated on a measurement, and not a weight basis. This is particularly so in large crates where the weight by measurement is invariably greater than if the crates were actually weighed.

In connection with the food-trough, it is suggested where the pigs are to be forwarded over long distances, that a supply of food (pollard and bran in equal parts preferably) should be placed in a sugar-bag and tied to the crate in such a way as to be readily accessible for use as required. A note attached to the waybill, asking that the food be mixed with water and given to the pig or pigs at certain specified stations, is also suggested.

The use of a stiff label attached to the crate, asking that the animals be given food and water, invariably results in attention being given as required.

Prompt Advice re Despatch.

Prompt advice concerning the despatch of this class of consignment is essential. Delay and annoyance is possible and additional risk is incurred. It is advisable to forward a telegram or letter, which insures as far as is humanly possible, satisfaction to both parties.

Freight Charges.

In cases where it is necessary to prepay freight, it is advisable to add the approximate amount to the price quoted for the animal and to effect the sale on a F.O.R. (free on rails) destination basis in preference to a F.O.R. sender's station rate. Delivery at destination is suggested in order to avoid the necessity of collecting freight after delivery has been given. If the purchaser's station is one at which permanent officials are stationed, freight may be charged and collected by the officials before delivery is given.

It would be a much better proposition if stud pig-breeders generally would quote for their stock on a cash with order basis, delivery to be given in crate at purchaser's station, all charges paid to that station. Many breeders will, of course, consider this quite an impossible proposition, but it has been found from experience that once the system is a practice and is explained to purchasers, it is superior to the return of crate method, which will always prove to be an unsatisfactory scheme.

Protective Covering over Crates.

Reference is made in the description of crates illustrated in Fig. 1 to the advisability of providing a hessian cloth cover over the top of the crates to ensure at least some protection from the rays of the sun, whilst the crates are awaiting delivery at senders' or purchasers' stations. This need not be an expensive item. An old chaff bag would be better than no covering at all.

Doors at Both Ends of Crate.

In crates used for the transport of mature stock or for large animals, it is a decided advantage to have a movable door at each end of the crate and to have this door effaced in such a manner that, when the "catch" or "pin" is released, the door may be readily lifted out to permit of the free ingress or egress of the animal. Such movable doors are not difficult to construct and are a decided advantage. Their addition need not necessarily increase the value of the crate very much. It is an advantage, too, where possible, to provide suitable handles at each end of the crate to allow of the crate being more readily moved about. For preference, these handles should be arranged so that they are movable, and may be turned down out of the way when crates are being packed in trucks.

Side Boards.

It is advisable that the lowest board on the side of the crate be at least 6 inches in width and that it be nailed or bolted close to the flooring boards. Where these lower boards are above the flooring, even if only 1 or 2 inches, the pigs' feet are liable to become injured by being forced through to the outer edge and becoming "jammed" if the crate is bumped or knocked about. Where boarding is used in the crate it is a decided advantage in ensuring that the bedding is not forced out of the crate.

Legs on Shipping Crates.

Most coastal, interstate, and overseas shipping companies require that shipping crates be provided with stout legs permitting of an open space of at least 4, and in some instance 6 inches underneath the crate. It would be advisable for breeders or their agents, who are concerned in the shipment of pigs in crates, to ascertain the regulations before arranging the delivery of the pigs at the wharf. The railway regulations governing consignments may be ascertained on application to any station master, from whom consignors will receive every courtesy and assistance.

"THE FARM PRODUCE AGENTS ACTS, 1917 to 1928."

The first Farm Produce Agents Act was passed in 1917, the objective being to ensure supervision over farm produce agents in their dealings with those for whom they were acting as selling agents. It was found that this Act did not meet all requirements, and, with a view to remedying defects and to render its administration more effective, the Minister for Agriculture and Stock (Hon. W. Forgan Smith), during the last session of Parliament, introduced an amending Bill. This measure was passed through all stages, and has now received the Royal assent.

The chief amendments relate to the keeping of trust accounts by agents, the prescribing of the books and records of transactions and their inspection by authorised persons, and the payment to principals of the proceeds of sales within a given period.

It is provided that all moneys received by an agent in respect of the sale of produce on behalf of a client shall be paid into a special trust account called the "Farm Produce Account." The Department of Agriculture is to be notified of the name of the bank in which this trust account is kept, while production of the pass book relating to the account can be demanded. Money paid into the trust account is protected and is not available for the payment of any other creditor.

An important clause is that which requires the principal to be paid within thirty days of the date of sale of the farm produce. There is nothing in the Act to prevent the agent paying his client as early as he pleases, but he must not delay payment beyond thirty days.

Power is given to prescribe the books and records of transactions which are to be kept by agents. Books, including the pass book of the trust account, must not be destroyed for at least twelve months from the date of the last entry therein. The Department has power to inspect these books and records with a view to seeing that the law is being carried out or to investigate the complaint of an aggrieved party to whom the Minister will have power to communicate the result of such inquiry.

The rendering of fraudulent account sales will make an agent liable to imprisonment for three years, or a penalty not exceeding £100.

The destruction by an agent of any farm produce which is in a marketable condition is an offence under the Act.

Where any offence against any of the provisions of this Act is committed by a corporation or joint stock company, the chairman of directors or manager or other governing officer is liable to the punishment provided unless he proves that the offence was committed without his knowledge or connivance and without any negligence on his part.

An applicant for a license must satisfy the licensing court that he is a fit and proper person to hold a license. He must notify the Department of the address of his registered office, and affix a sign on his premises bearing the words "Licensed Farm Produce Agent." The fixation of commission charges has been left in the hands of the Board of Trade and Arbitration. There is nothing in the Act to which any straightforward agent will take exception, nor is there any provision which will in any way curtail the full exercise of their functions as farm produce agents. Most of the agents are carrying on their business satisfactorily, and the amendments to the Act will cause them no concern.

The Act now embodies all features which the administration of the original Act has shown to be necessary or advantageous.

Photo.: Miss J. Easton.]

PLATE 184.—IN THE SHADE OF THE OLD APPLE TREES. SCENE ON COOCHIN COOCHIN STATION, NEAR BOONAH. MOUNT EDWARDS IN THE CENTRAL DISTANCE.

MILKING BY HAND.

By PRIMROSE McCONNELL.*

Nine years ago, under the "Dairy Farmers' Notes" heading, an article on hand milking was published in the "New Zealand Farmer," but quite lately there have been repeated requests for advice on this very important matter, hence the present article.

While it is true that the milking machine has come to stay, and that it does excellent work under careful management, there are still circumstances under which hand milking is preferable to the machine, not to mention the fact that machines occasionally break down and the human hands have to take their place for the time being.

It seems to be the general opinion that dairy farms will become smaller as time goes on, and if this opinion proves to be correct, hand milking may become a great deal more common than it is at the present day. On a small farm, where the farmer possesses, as a rule, a proportionately small capital, it has to be seriously considered whether the outlay on a complete milking plant is justified, or profitable, and the labour required to keep a small plant thoroughly clean is almost as great as that in connection with a larger one. One man will easily milk a small herd of, say, twelve cows by hand, and the only utensils required in the milking shed are a milking pail and a larger carrying can, the cost of which is a mere trifle, as is also the cost of keeping it in repair.

Further, there is no doubt that, although a well-handled milking plant does good work, and is a present-day necessity in larger herds, it is not as efficient as the best hand milking; no record-breaking cows are ever milked by machinery. On the other hand, a bad hand milker is worse than a second-class milking machine badly handled.

Hand milking is an art and requires undivided attention, energy, and knack. Women, as a rule, make the best hand milkers, as their hands are small and soft.

Putting the Cow in a Good Humour.

There are several things which have a direct bearing on successful milking, besides skilled manipulation of the hands, and the principal thing is to put the cow in a good humour for the operation. This is accomplished by gentle handling from the time the cows are being driven to the milking shed until they leave it after milking.

A herd of cows should be taught to come when called on and not be rushed with dog and stockwhip. A gentle pat and a kindly word have quite the opposite effect to a growl and a blow before the milker sits down to his work.

Various Systems of Hand Milking.

The first part of the operation, whether the milking is done by hand or machine, is to thoroughly wipe the udder and flank with a damp, clean cloth wrung from some germicide solution; then draw a stream or two from each teat on to the floor or into a small tin containing a strong solution of crude carbolic acid. The object of the latter operation is twofold—namely, the ejection of any germs that may have gained admittance to the outlet of the teats, and to discover whether there is any sign of mammitis. The little milk that is ejected is almost valueless in any case, as it is always very watery and contains little or no fat.

The udders of heavy milkers are often tender, and for this reason the milking should be commenced very gently, always keeping in mind that gentle handling promotes the flow of milk. On the other hand, if the cow is excited through any cause, the reflex nervous action causes the tissues of the udder to shrink, and the milk is held up.

The position of the milker when sitting should be as close to the cow as possible, with his or her head pressed lightly against the flank. Many milkers sit too far away from the cow, and are neither in a position to control her movements, or to manipulate the teats in a proper manner.

When the milker is sitting in a correct position, if the cow has the habit of lifting her leg, the action may be stopped to a great extent, by pressing the arm against the hollow of the hock.

Some milkers milk with dry hands, and others with wet, and I have seen good milking done either way, but the ever increasing demands of sanitation will soon make wet milking a thing of the past; for my own part, I think it is a filthy habit. It is

* In the "New Zealand Farmer" for August.

too well known that comparatively few hand milkers wash their hands during milking, yet, every now and again, the dirty fingers are moistened in the contents of the milk pail. Is such a habit commendable? A good, dry-hand milker never unduly stretches the teats, but the wet-hand milker almost invariably does.

As previously stated, the initial manipulation should be gentle, and the pressure of the hands gradually increased, until the flow of milk reaches its height. Some quite good milkers milk a fore and hind teat together, but it is better to commence with the two fore teats, with the object of developing the forequarters, which are generally smaller than the hind. So far as efficiency of milking is concerned, it does not really matter which way is adopted, as long as the method is the same day after day. When the cow has filled her teats with milk, the action of the milker should be fairly vigorous. The pressure should be upwards, against the floor of the udder, so as to resemble the sucking of the calf as much as possible, and the teats should not be let go until the quarters are empty. A thoroughly efficient, dry-hand milker will never use a finger and thumb, even in stripping out. Whether he gets two, three, or four fingers on the teats, will depend on their size, but in any case, he will hold on to the end without resorting to the finger-and-thumb process.

A learner's muscles are easily cramped, and the temptation to use finger and thumb is, at first, great, but by determination and perseverance the muscles are hardened, and the strain overcome.

Some milkers are in the habit of drawing the teats downwards to such an extent that the whole hindquarters of the cow are kept in constant motion. There should be very little downward pressure—it should be mainly horizontal. When milking, there should be practically no movement of the arms, except such as is caused by the action of the muscles, and the teats should be pressed against the hollows of the hands by the tips of the fingers. Many milkers entirely encircle the teats with their fingers, but a moment's thought will serve to show that this is an incorrect position, because the outlet from the udder is only a very small tube in the centre of the teat, and it stands to reason that the pressure should be exerted on this part principally, and not on the teat as a whole. The hands should enclose more of the udder towards the end of the milking, until the last drop is drawn.

Of course, I am perfectly aware that the milker's patience is often severely tried, and it is more than probable that the poet who writes so charmingly about the milkmaid and her duties, was never inside a cowhouse during milking time, in early spring, when the pastures are young and lush.

Clean, expeditious milking not only increases the yield of milk and butter-fat—it also develops the udder, the result being a gradual increase in the flow of milk. It will not, of course, make a bad milker into a record-breaker. Quick milking is a good test of milking abilities, and results in the largest possible quantities of milk, with the highest percentage of fat, and there is plenty of evidence to prove that the variations of fat contents of milk are to some extent due to bad milking, whether by machine or hand.

Milking three times a day is sometimes a necessity, but, speaking generally, little is gained by it. No farm employee is so worthy of a good wage as an efficient milker. Although his work is not laborious, his hours are long, and his duties apt to become monotonous.

Stripping.

There is great variance of opinion as to the necessity, or otherwise, of stripping. The result of my own experience, which is a very long one, has led me to conclude that if a cow is once thoroughly milked, no good can be done by stripping; but where there is a number of milkers, some of whom are not trustworthy, stripping is a necessity, and where the milking machine is in use, it should never be omitted.

A careless employee may milk until he can get no more, but his indifferent manner of milking will cause the cow to hold up some of her milk, which the very best stripper cannot make her yield up.

If a cow has sore teats, she requires the greatest patience in handling, and no treatment of the sores will yield good results, except they are thoroughly washed and dried in the first place.

Some cows have very hairy udders, and the unavoidable pulling of the hairs, in the process of milking, causes much irritation, but this may be entirely prevented by the free use of a pair of clippers. Many cows also suffer much, just after calving, from hard, swollen udders, and nothing will cure this as quickly as persistent hand rubbing. An aperient medicine will also be of service.

PAINTING ON THE FARM.

SURFACES REQUIRING SPECIAL TREATMENT.

In the painting of farm buildings there are often materials to be covered for which the paint used for timber is not suitable, such materials including cement and galvanised iron.

The paint ordinarily used for house painting should not be applied to new cement, which contains an alkali which will cause the paint to lie on the surface in a treacle-like form—that is, it will not dry, but always remains in a wet, sticky condition.

Untreated cement work should not be painted until it is about two years old except with cold water paint, lime wash, or one of the proprietary lines of paint specially manufactured for the purpose. If desired it can be prepared for ordinary paint by applying two coats of sulphate of zinc. When dry the surface should be brushed down to remove all crystals; it may then be painted in the ordinary way. A very satisfactory priming coat for weathered cement work may be had by mixing one part of red lead to two parts titanium zinc paste.

Asbestos Cement Sheets.

The foregoing references to cement apply more or less to asbestos cement sheets, for they are principally of cement, and although they contain considerably less free lime, it is inadvisable to paint them when new with ordinary paint without special treatment. It is advisable to allow the sheets to weather for about twelve months and then apply a coat of equal parts of genuine turpentine and hard oak varnish. If to this, a coat of paint consisting of one part of red lead to three parts of titanium zinc is applied, a first-class foundation will be provided for further painting.

In the case of internal surfaces, a coat of preparatory liquid will prepare them for one or two coats of cold-water paint, or the even more pleasing flat oil paint, many attractive shades of which are now available. Cold-water paint may be applied externally in lieu of oil paint if desired. For this purpose it will be necessary to add about one-quarter of a pint of raw linseed oil to the gallon of water paint.

For ceilings, kalsomine is recommended in lieu of cold-water paint. It often happens that repeated applications of this latter material begin to crack and peel off in a very unsatisfactory manner. This cracking does not occur on the walls to anything like the same extent.

Galvanised Iron.

Under the heading of iron may be included roof iron, guttering, downpipes, tanks, and water pipes. In all these instances the iron is galvanised to prevent it rusting, so that, to some extent, painting is only necessary after the galvanising shows signs of wear. Guttering, downpipes, &c., are usually painted for appearance immediately the building is completed, and with one good coat only. It is better not to paint the roof iron until it has been exposed to the weather for a few years. Because of the continual contraction and expansion due to the extremes of heat and cold, and the want of a good grip or key, ordinary house paint is not suitable. It is always advisable to use a high-grade paint specially manufactured for the purpose.

Formula for Whitewash.

Obtain, if possible, large pieces of fresh lump lime, place them in a very large bucket or other suitable container, and into this pour hot water. Cold water will do, but hot water is better, as it hastens the slaking. The lime will start to boil and break up. Keep it covered all the time with about half an inch of water. This is important, for if whilst the lime is slaking it is allowed to rise up above the water in a dry powder it will "curdle," a condition tolerated only by inexperienced and indifferent workmen. Before the lime commences to boil fiercely add tallow or common fat in the proportion of about 1 lb. to 14 lb. of lump lime. This makes a good binder which will prevent the wash from rubbing off. If desired, a little yellow ochre may also be added, which will give a cream or buff tint according to the quantity used. When the lime is thoroughly slaked it should be stirred and sufficient water added to make it a little heavier than, say, milk, after which it should be strained and, if desired, may be applied whilst hot.—"A. and P. Notes," N.S.W. Department of Agriculture.

Answers to Correspondents.

Testing for Tuberculosis.

J.O. (Stanthorpe)—

The Chief Inspector of Stock, Major A. H. Cory, M.R.C.V.S., advises that the tuberculin test will not seriously affect the milking of your herd, but bailing the cows up every third hour for a period of eighteen hours to take their temperatures after treatment may affect the milk supply, but only very slightly.

Phosphorus Deficiency in Cattle.

J.H. (Pomona)—

Your inquiry as to the amounts of the ingredients to add to a 100-lb. bag of bonemeal as a lick for stock was referred to the Agricultural Chemist, Mr. J. C. Brünnich, who advises as follows:—

The cattle undoubtedly suffer from want of phosphorus, and no other ingredient like iron, gentian, &c., is at present required. Bonemeal may be used if sterilised, but I recommend crushed Nauru phosphate, which is so much cheaper and contains much more phosphoric acid.

Mix 1 part of salt with 2 parts of Nauru phosphate or bonemeal. You can springle a little molasses on the mixture to make it more palatable. No extra lime is required, and would really be harmful.

BOTANY.

The following replies have been selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.:—

Soudan Grass—A Useful Fodder.

V. and Son (Miriam Vale)—

The specimen of grass forwarded with your letter is the well-known fodder Soudan Grass (*Sorghum sudanense*), which should be a valuable grass for your district, either as green forage or for hay. Like all, or practically all, grasses of the Sorghum group it develops at times a prussic-acid yielding glucoside, and caution should be exercised in feeding it to stock, especially stock that are empty and inclined to gorge themselves on it.

Sterculia quadrifida.

R.A.D. (Orkabie)—

Sterculia quadrifida is a tree widely spread throughout Queensland, but it cannot be said to be common in any one spot, and I do not know a common name for it. It is a beautiful tree when in fruit, and the seeds that are removed from the black coating and the inner coating are edible and of a pleasant flavour when fresh.

Macrozamia.

P.B. (Harlin)—

Macrozamia spiralis is commonly known as Burrawang, Wild Pineapple, Zamia Fern, and by other names. It belongs to the family Cycadaceæ, the oldest family of living flowering plants.

In Macrozamia the male and female flowers are borne on distinct plants, and both in heads or cones, the cones being composed of a number of scales. In the female cone each scale bears on its lower surface two ovules which later develop into bright red seeds. In the male cone the scales bear on their lower surface innumerable anthers full of pollen.

The plants are generally regarded as poisonous and are very common in parts of Queensland and New South Wales. Another species is common in Western Australia. They cause rickets or staggers in stock. However, the stem, particularly in those species which form a fair-sized stem, contains a lot of starchy matter which can be boiled and used for stock food, the heat apparently destroying the poisonous principle.

Poisoning of Stock.

J.T. (Maryborough)—

The specimen forwarded with your letter has been identified as *Rivina lævis*, a tropical American plant very common as a naturalised weed in the scrub areas between Gympie and Maryborough. It gives a very unpleasant taste to milk, but apart from that it is not known to possess any harmful properties.

The other plants you mention—the Wild Passion, Wild Peach, and Solanum Seaforthianum (Nightshade)—are known to be poisonous, but in these scrub areas it is often very difficult to trace the poisoning of stock to any one particular species. If the Solanum has been eaten, I should think it was the most likely cause of the trouble.

PIG RAISING.

The following reply has been selected from the outgoing mail of the Senior Instructor in Pig Raising, Mr. E. J. Shelton:—

Lack of Vitamins and Mineral Matters in Food.

C.C.E. (Cloyna)—

Your boar is suffering from a lack of mineral matters and vitamins in his food, and is generally lacking in bowel and bladder action.

Treatment must first aim at cleaning out the digestive tract and removing any accumulation of undigested food. For this purpose prepare five grains of calomel and one teaspoonful of sugar; mix this in a small ball of moistened pollard and feed to the boar early in the morning. About twenty-four hours afterwards give two ounce packets of Epsom salts in one pint of fresh milk; give this as a drench to ensure the animal taking the full dose. This should effectively clean out the bowels. Feed very lightly on nutritious, appetising food, of which more than half should consist of green lucerne, pumpkins, sweet potatoes, and skim milk. Very little grain is required but allow plenty of clean drinking water and compel the boar to take regular exercise daily. On the third day of the treatment add to the food one dessertspoonful of Nauru phosphate (finely powdered) and ten grains of boracic acid, giving a small quantity of food only when these drugs are being administered. Give the phosphate and boracic acid in one pint of fresh milk in a clean trough.

Mix the phosphate and boracic acid as dry powders first, then add a small quantity of milk to make a paste and thin down with balance of milk for use. Continue with the above for fourteen days; after that add one dessertspoonful of Nauru phosphate daily in one pint of fresh milk.

WORLD'S BIGGEST PLANE.

The acceptance by the Royal Air Force of the world's largest aeroplane, the Beardmore "Inflexible," upon its passing all the official tests, brings to light a remarkable story of the British general strike.

The biggest tyres and landing wheels ever built were ordered for the machine from Fort Dunlop just before this prolonged industrial dispute, and, naturally, there was nothing to go on in the way of design. It was a new problem demanding special tools and machinery at a time when many of the sources of supply of raw materials were shut off.

First it was found that in this size the normal type of wheel with spokes was impossible. The technical department at Fort Dunlop had therefore to face the production of an altogether new type of wheel. They had to reject much of the available raw material as quite useless. When the new wheels were finally in being, a special testing machine had to be built for them, because they passed far beyond the limits of any such machine already in existence.

Their breaking load was, in fact, over 48 tons, an astonishing victory in such a time of emergency, and the tyres required for them were of record size—400 mm. by 2,250 mm., or about 16 inches by 7½ feet in diameter.

General Notes.

The Role of the University.

"A University is one of the instruments by means of which new ideas and groups of ideas find organised expression; it trains collaborators who work out the implications and corollaries of new ideas; through a network of personal influence it carries new ideas into the professions and public services. In the main a University is mediatory rather than originative, critical rather than constructive. Its strength lies in winnowing new ideas, in interpreting discoveries and disclosures which others have made, in colouring by slow degrees the texture of educated opinion. These are the duties for which the characteristic structure of the modern or modernised University is especially designed."—Sir Michael Sadler.

Northern Pig Board.

The Minister for Agriculture and Stock (Hon. W. Forgan Smith, M.L.A.) advises that the following nominations for election as members of the Northern Pig Board have been received:—Frederick Henry Hyde, Peeramon; Charles Alfred Hough, Tolga; David Johnston, Malanda; Robert Thomas Croker, Malanda; Robert Campbell, Peeramon. As five members are only required, no election will be necessary.

Messrs. Croker, Johnston, Hyde, and Campbell are sitting members of the present Board, which terminates on the 31st December, 1928.

Saving Money.

There are many ways of saving money, but one of the best, since we have to spend it on occasion, is to see that we spend wisely, thereby saving pence, shillings, and in many cases pounds that would otherwise go to the other fellow.

In the matter of purchasing household supplies, wire netting, iron, and the many items that are used on farm and station considerable saving can be effected by dealing with the Queensland Pastoral Supplies Ltd., the well-known providers in Bowen street, Brisbane, who supply the public direct.

A glance through their advertisement, which appears elsewhere in this issue, will prove this. Catalogues listing many lines will be forwarded post free on request, and it will certainly pay any producer who has not already received one to write for a copy immediately.

Staff Changes and Appointments.

Mr. F. W. Dunster, of Toowoomba, has been appointed an Officer under and for the purposes of the Animals and Birds Acts.

Mr. G. Cross, of Goonaro, Hebel, has been appointed Honorary Inspector of Stock.

Constable J. H. Teichmann, of Pentland, has been appointed Inspector of Slaughter-houses.

Mr. G. A. Cameron, Police Magistrate, Townsville, has been appointed Chairman of the Inkerman, Kalamia, Pioneer, and Invicta Local Sugar Cane Prices Boards, *vice* Mr. T. R. Kennedy, Police Magistrate, resigned.

Mr. D. McLaurin, Temporary Inspector under the Diseases in Plants Acts, has been admitted to the Public Service and, together with Mr. S. A. Green, Clerk of the Department of Agriculture and Stock, has been appointed Inspector under the Diseases in Plants Acts, as from 1st November, 1928.

Mr. C. C. Parkinson, of Coorparoo, Brisbane, has been appointed Inspector on Probation, Agricultural Bank, as from 24th September, 1928.

Messrs. James Arthur Kerr, Foreman of the Stock Experiment Station, Townsville, Max Rose Muller, Temporary Inspector of Stock, Kingaroy, and Stanley Crawford Allan, late of Keeroongooloo, have been appointed Inspectors on probation under the Diseases in Stock Act. Messrs. Kerr and Allan will be in the Helidon Cleansing Area, and Mr. Muller in the Burnett district.

Messrs. W. H. Stobbs and K. R. Hack, of Nerang, have been appointed Honorary Inspectors under and for the purposes of the Diseases in Plants Acts.

Queensland Butter Achieves Remarkable Distinction.

Many dairy associations have been awarded prizes of merit at the dairy show recently held at Islington. The competitions were open to manufacturers of butters within the British Dominions, and there were seventy-five entries made in one class. The Co-operative Dairy Association, Gayndah, was successful in gaining the third place of merit in the Salted Butter Class, but it was in the Unsalted Butter Class that Queensland manufacturers achieved remarkable distinction. In this class the Oakey Dairy Association gained the first award. The Maryborough Co-operative Dairy Association was awarded third place, and the Downs Co-operative Dairy Association was very highly commended on the exhibits manufactured at Dalby, Goombungee, and Toowoomba factories. The results indicate that the manufacturers of butter in this State are continuing to maintain a high standard of quality and are sparing no effort to further improve that standard wherever it is possible to do so. The good reputation that is enjoyed by Queensland dairy produce on the overseas markets will be further enhanced as a result of the success that has been achieved at this important competition at the Dairy Show at Islington.

Valedictory—Mr. C. W Shenton.

The officers of the Department of Agriculture and Stock assembled on Friday, 9th November, to bid farewell to a fellow-officer, Mr. C. W. Shenton, who has resigned from the public service after eleven and a-half years' service in the Department.

The Under Secretary of the Department, Mr. E. Graham, when presenting Mr. Shenton with a handsome eight-day clock on behalf of the officers, referred to his efficiency in carrying out the duties which had been entrusted to him, and to the popularity and esteem in which he was held by all members of the staff. He very much regretted that the Department was losing the services of such a promising officer, and wished him every success in his future career.

The Under Secretary's remarks were supported by Mr. S. S. Hooper, accountant, in whose branch Mr. Shenton had been employed during his term of office. Mr. Shenton suitably replied.

Control of Banana Weevil Borer.

The Minister for Agriculture and Stock (Mr. W. Forgan Smith) has drawn attention to the recent return from Java of an officer of the Entomological Branch of this Department. The officer in question (Mr. J. L. Froggatt) was sent to Java in May of this year primarily with the object of conducting an investigation into the question of the control of the banana weevil borer in that country. As it was believed that natural enemies played an important part in controlling this highly destructive insect, particular attention was devoted to that aspect of the investigation.

Mr. Forgan Smith said that as a result of Mr. Froggatt's work colonies of two enemies of the borer had been introduced to Queensland. One of these enemies was the maggot of a fly which is believed to be of material assistance in reducing borer infestation in the Dutch East Indies, and he was pleased to be in a position to state that a colony of this beneficial insect had already been liberated at Cooran. The other beneficial insect had not yet been liberated, and it is still being handled in quarantine in accordance with the precautions considered necessary in introducing such insects.

Emphasis was laid on the fact that although it was hoped that the introduced insects would eventually be of material assistance to the banana grower in his fight against the borer, immediate relief could not be expected. Even if the natural enemies do become permanently established in the field, some considerable time must elapse before they have bred up in sufficient numbers to exercise an appreciable degree of control. In the meantime, therefore, Mr. Forgan Smith strongly recommends banana growers to enthusiastically adopt the control measures recommended by the officers of his Department, and in particular to extensively use the poison baits for the destruction of the adult borer or beetle.

Mr. Froggatt also investigated other factors responsible for borer control in the Dutch East Indies.

The Minister further stated that a number of new varieties of bananas had also been brought back from Java, and these would be grown in strict quarantine for not less than two years. This precaution was being taken in order to eliminate, as far as is humanly possible, the danger of introducing further pests or diseases with the new varieties.

Lucerne—Use the Cultivator.

Lucerne sown in autumn should receive no cultivation until the following spring at earliest. The young plants are tender, and will not stand rough handling. On friable, loose soil, especially, the effect of cultivation would be to pull many of the plants out, and consequently the harrowing must be light, and should not be attempted until the roots have firm hold; but after the second cut, particularly on ground that sets hard, the harrow can be used.

The method of keeping early spring weeds in check is to mow frequently. The mower should be put over the crop before any of the weeds have commenced to flower, and the operation should be repeated a month or two afterwards. Two mowings will generally be sufficient. They must not be omitted if weeds are getting a foothold, even if the lucerne is not ready to cut, as the object is to destroy the weeds. If the quantity should warrant it, the cut material can be raked for green feed, but if left on the ground it makes a useful mulch.

Once lucerne becomes well established its vigorous growth keeps most weeds in check, but a certain amount of cultivation is necessary. A rigid-tine cultivator is the most suitable implement. The lucerne fields should be given a thorough stirring with this in July or August, and, if necessary, again later in the season. The loosening of the surface allows moisture to percolate to a greater depth, and prevents it from flowing away over the surface. Owing to the depth to which even light showers then penetrate, less loss occurs through evaporation.

If a rigid-tine cultivator is not available, a springtooth cultivator can be used very effectively if fitted with narrow tines specially designed for the cultivation of lucerne fields.

Obituary.

The untimely death of Mr. George Sutherland, B.Sc., A.A.C.I., on the 23rd October is generally regretted. Mr. Sutherland was engaged in the chemical laboratory of the Department of Agriculture and Stock for several years prior to his illness, and was formerly an officer of the Income Tax Office and of the Aboriginals Department. He was well known at the Queensland University, where he achieved fame by his brilliant successes. During the war he enlisted and served his country on the fields of France and Egypt. It is generally felt that Queensland has lost a much-respected and highly-esteemed young scientist in the passing of Mr. Sutherland, and widespread sympathy is extended to his wife and family.

Hints on Soldering.

The materials necessary for soldering are one or two soldering irons, some sticks of solder, a bottle of muriatic acid (spirits of salts), and a small block of sal ammoniac. A handy container for the fire in which to heat the irons can be made out of an empty benzine tin or oil drum by cutting out the top, punching a few holes in the bottom, and cutting a hole in the side within an inch or so of the bottom, so that the heads of the irons can be passed through into the fire.

To prepare to solder, pour into a bowl (glass or ware—not tin or galvanised-iron) a quantity of the spirits and add a few pieces of zinc to "kill" the liquid. The soldering iron is first heated to a dull red heat, a fair portion of the point is filed clean, and this portion (while the iron is still hot) is rubbed with the sal ammoniac. The clean point is then tinned—that is, coated with solder—and this is of great importance if good work is to be performed later. To tin the iron, run a little solder on to a piece of clean tin, alternately turning its point in the melted solder and dipping it in the killed spirits.

Before using the soldering iron, clean the joint to be soldered, and with the aid of a brush put on a little of the killed spirits. The iron should be hot enough to make the solder run freely, but do not let it get red-hot. Withdraw it from the fire, brush the point with a piece of bagging, and dip it in the prepared spirits; then place the point of the iron on the joint to be soldered and move it slowly along, supplying solder as required by placing the end of the solder stick against the iron near the point. When soldering a loose patch, it will be found convenient to run a drop of solder on to the joint first, then hold the patch firm with the aid of the solder stick while the iron is operated to make the patch firm. The edges of any joints to be soldered should be fitted neatly and closely together, and the solder should run freely and adhere almost as if it were part of the tin.

Arrowroot Board and Arrowroot Flour.

The Governor in Council has approved of the issue of a notice notifying his intention to place arrowroot flour under the control of the Arrowroot Board. Provision to permit of this was made in "*The Primary Producers' Organisation and Marketing Act Amendment Act of* 1928."

Any petition for a poll to decide whether or not this Order shall be made must be signed by at least fifty growers or manufacturers of arrowroot, and must reach the Under Secretary, Department of Agriculture and Stock, Brisbane, before the 18th December, 1928.

For the purposes of the petition, an arrowroot grower is one who has supplied arrowroot bulbs grown by himself to any arrowroot mill in Queensland at any time during the past twenty-four months, and an arrowroot manufacturer is one who has manufactured arrowroot flour at any time within the past twelve months.

Banana Suckers Affected with Bunchy Top.

Some little time ago a deputation of banana-growers waited upon the Minister for Agriculture and Stock (Mr. W. Forgan Smith) at Parliament House in connection with the matter of the eradication of banana suckers affected with Bunchy Top from the plantations owned by them at Camp Mountain.

During the discussion on this matter a suggestion was made to the effect that, provided the Minister would arrange that the inspectors under the Diseases in Plants Act would go through the plantations simultaneously with a working bee which would be constituted by the growers, the latter would forthwith carry out the destruction of any suckers infested with Bunchy Top. Some half dozen plantations were situated within the area over which it was intended the working bee should operate.

The Minister has since received a report from his officers advising that the work of eradication of Bunchy Top plants has been effected in six plantations comprising an aggregate area of about 105 acres. The working bee has been effective and has achieved its objective. From a Departmental point of view the results from the working bee are satisfactory. It is understood, however, that some of the growers found that on account of the fluctuation in the area under bananas on the individual farms there was difficulty in arranging the work on an equitable basis. The varying percentage of affected plants in the plantations added to this difficulty.

As far as is known, this is the first occasion on which a working bee has been constituted for the purpose of cleansing a group of plantations of different ownership of Bunchy Top.

Graze Succulent Feed with Care Conditions Conducive to Bloat.

Bloat, or hoven, is due to succulent foods eaten under certain conditions which cause the formation of large quantities of gas in the rumen or paunch, and in consequence a swelling of the left flank. It is most often seen (*a*) when cattle are turned hungry on to such succulent green food as lucerne, clover, &c.; (*b*) when cattle used to dry feed are suddenly changed on to green, soft food; (*c*) when travelling cattle are allowed access to large amounts of green food, such as variegated thistle; (*d*) when cattle gorge themselves on wet grasses or herbage; and (*e*) when cattle are fed on roots or potatoes under certain conditions. Some animals appear to be more subject to hoven than others.

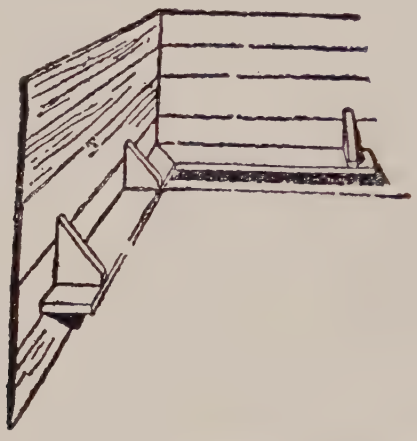
Keeping the mouth open with a gag, or a piece of wood, until the beast has belched most of the gas by mouth will be useful in mild cases. The internal administration of 1 oz. of bicarbonate of soda and 1 oz. of ginger is sometimes useful, and it may be repeated in a few hours if necessary. In a bad case the most effective treatment is the puncture of the paunch. This is done on the left side in the flank—at a point equidistant from the last rib, the edge of the loin bones, and the angle of the haunch. The correct instrument for this purpose is trocar and cannula.

The cannula is a tube through which passes a sharp-pointed instrument—the trocar. This instrument is thrust into the rumen, and the trocar is withdrawn, leaving the cannula in place, and through this the gas escapes. In case of emergency a knife may be used in the same way, the gas escaping through the cut; but complications may set in and cause death if this is not done expertly. After the gas has escaped the animal might be given a dose of linseed oil (1½ pint) and turpentine (1 tablespoonful). This mixture should be well shaken up while being given.

Every effort should be made to prevent the occurrence of hoven in stock. In feeding lucerne and clover, if the animals are not used to it, they should be put on it gradually until they become accustomed to it. If lucerne is fed in a wet state, or after heavy rain—when it is soft and juicy—it will almost always produce trouble; and cattle should, therefore, be kept off it until it is drier.—"A. and P. Notes," N.S.W. Ag. Dept.

A PROTECTION RAIL FOR YOUNG PIGS.

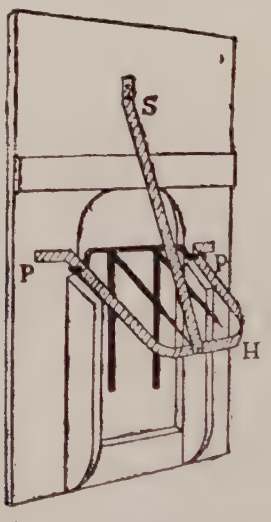
The simple device shown here is often the means of saving many lives. A 2 by 4 inch or a 2 by 6 inch piece of timber is placed about 8 inches above the floor of the farrowing pen, and nailed firmly to the side walls in the manner



illustrated. The sow's body may go against the side of the pen and strike the rail or fender, and if a little pig is there he has some chance of not being squeezed to death, because the rail keeps the weight off him.

SAFEGUARD AGAINST FOXES.

An ingenious fox-excluder for outlying poultry houses in use in Lincolnshire, England, was illustrated in the "Farmer and Stockbreeder," from a sketch supplied by Mr. A. Tyler, country poultry lecturer for Lincolnshire. The two vertical iron rods in the entrance hole are attached to a crossbar which pivots at PP and



also carries a two-spiked rod in such a way as to allow the birds to enter without injury, but would preclude the entrance of anything the length of a fox. The crank in the pivoted bar serves to reduce the effort required to push the rods into a horizontal position. Danger to other stock is obviated by hoop-shaped guard, H, braced by the stay, S.

The Home and the Garden.

MATERNAL AND INFANT WELFARE.*

While pondering on what aspect of the above subject—the most vital of all Australian problems to-day, as it seems to me—I happened in my evening paper on a glowing tribute to the British constitution under which it is our good fortune to live.

The speaker is Premier Taschereau, the French-Canadian leader in the province of Quebec. Sprung from a nation once the bitterest of our enemies and the formidable rival of England in the titanic struggle of a hundred years for mastery in the colonial world, that statesman, now proud to be a subject of the King, glories in eloquent words in the charter of our liberties.

"The British constitution," says he, "wherever applied, is the most perfect governmental instrument that man has ever devised, making for liberty in its truest meaning, justice on its broadest lines, and peace under its most acceptable form."

A special virtue of our constitution is that, though the best ever, it is still in the making; growing from age to age, to a higher level of completeness. And another essential fact is that, inspiring it all, and animating its evolution, is the soul of a people, with great traditions in the background of history, and, if it prove true to itself, with a glorious message of peace and goodwill for the future of the world.

The Answer.

But, you may ask, what has this to do with the domestic function of motherhood and the nursing of babes? The answer is, it has everything to do with that. It is our duty and privilege to maintain this race in its purity, its lofty motives, its passion for freedom, its humanity. Many times has it drawn the sword to crush the oppressor and proclaim enfranchisement to them that were bound. For centuries the eyes of all nations have turned to it as the ensample and Paladin of Liberty.

A Vital Factor.

And we should never forget that a sound motherhood is the most vital factor for the true prosperity of any people; while, conversely, no deeper injury can be dealt to the body politic of Australia than that we should so far fall from grace as, by any malign activity, or any defect of duty, to suffer injury to reach the mothers and children of the nation.

Unfortunately, great injury is now being incurred by death and disease among these, the most precious assets of the State and the family, considered from any standpoint—humane, moral, spiritual, economic. The family is the basis of our civilisation. On its wellbeing hangs the fate of Australia present and to come.

On these grounds I prize the opportunity of laying my views, formed not without some care and pains, before the country women of New South Wales through the organ of their association. There are two agencies in this State to which all women owe a debt of gratitude—the public Press and the statisticians.

For the last seven years, since I first wrote on maternal welfare in the journals, the Press generally has given liberal space to the discussion of this subject. "Country Life" has been specially generous.

Most politicians seem incapable of understanding; or, at all events, show no zealous interest; and the general public is indifferent or indolent, except when roused under the lead of a group of energetic women. But the pressmen at once grasped the meaning and national importance of the welfare of motherhood. A journalist is ready to listen; and, if he approves, will espouse a public cause and speak his views aloud.

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* From "An Open Letter to Any Country Woman," by A. Watson Munro, M.D., in "Country Life" (Sydney).

Of the Statisticians.

Of the Government statisticians I can say, after considerable experience in Commonwealth and State, that I am deeply impressed with their impartiality and eagerness to get and give information.

They will not make statements except on the plain facts and figures. They form an invaluable factor in civilisation. One might say, in an important sense, that statistics are civilisation.

Improving Visibility.

And here let me clear away, to begin with, some obscurity that exists in the minds of many women, regarding the accuracy of the statistics of maternal mortality.

Quite recently, a member of parliament, having read some of my letters in the Press, took great interest in the figures quoted. He asked some questions. One was: "May it not be that the mortality figures cover more than actual maternal mortality—that is, more deaths than are directly the result of childbirth?" Here is my reply.

"The Answer is, Decidedly No."

Let me explain the meaning of a few terms. The term "childbirth" when used by statisticians and authorities on public health signifies the whole tale of gestation, starting from conception, on through pregnancy and parturition (delivery), right to the end of convalescence of the mother. And accordingly, by "mortality of childbirth" we mean the death of a mother at any point along that line of events.

If you consult official statistics, you will find a table of the various "causes of death" in childbirth. That list is based on the Bertillon system of classification, which is now used by the various European nations and Japan. By using it, we are able to make comparisons on a common basis, giving due allowance (as we always must, in human operations) for variation in some details of compilation; thus France, for example, differs from British countries in the definition of "stillbirth."

Childbirth.

Remember (looking at the list of causes referred to) that women do not die simply of childbearing at the full term of pregnancy. What they die of is the complications thereof. Childbearing is a natural (physiological) act., analogous to the other vegetative functions of all living beings, such as swallowing or digestion or excretion.

But all these functions may be perverted by disease. Childbirth may become "pathological" or complicated; as by neglect of Nature's laws, of commonsense, of proper nourishment. Thus rickets, a dietetic disease of girlhood, and it may so deform the pelvis (the bony tunnel through which the infant travels) that in later life ordinary delivery is impossible.

Also, woman (like man) has "sought out many inventions." On the patient's part I mention unhealthy living, regimen, eating and drinking, dress; and (alas!) on the part of some obstetricians, male and female, a tendency to treat labour as if it were a disease, and resort to interference with its gradual and natural course.

Troublesome Tinkering.

Such tinkering with the divinely planned mechanism for the perpetuation of the human race is practised mainly through ignorance, following on superficial study and defective practical training.

Ignorance will always peddle and fuss, where knowledge would "look before and after." Ignorance in action is an appalling spectacle. It has often led to disaster in human affairs. Warnings against this error, which seems to be on the increase in midwifery work, have lately been raised, again and again, by leading obstetricians here and in the homeland.

KITCHEN GARDEN.

A first sowing of cabbages, cauliflower, and Brussels sprouts may now be made in covered seed beds, which must be well watered and carefully protected from insect pests. Sow in narrow shallow drills; they will thus grow more sturdy, and will be easier to transplant than if they were sown broadcast. The main points to be attended to in this early sowing are shading and watering. Give the beds a good soaking every evening. Mulching and a slight dressing of salt will be found of great benefit. Mulch may consist of stable litter, straw, grass, or dead leaves. Dig over all unoccupied land, and turn under all green refuse, as this forms a valuable manure. Turn over the heavy land, breaking the lumps roughly to improve the texture of the soil by exposure to the sun, wind, and rain. In favourable weather, sow French beans, cress, cauliflower, mustard, cabbage, celery, radish for autumn and winter use. Sow celery in shallow well-drained boxes or in small beds, which must be shaded till the plants are well up. Parsley may be sown in the same manner. Turnips, carrots, peas, and endive may also be sown, as well as a few cucumber and melon seeds for a late crop. The latter are, however, unlikely to succeed except in very favourable situations. Transplant any cabbages or cauliflowers which may be ready. We do not, however, advise such early planting of these vegetables, because the fly is most troublesome in February. For preference, we should defer sowing until March. Still, as "the early bird catches the worm," it is advisable to try and be first in the field with all vegetables, as prices then rule high. Cucumbers, melons, and marrows will be in full bearing, and all fruit as it ripens should be gathered, whether wanted or not, as the productiveness of the vines is decreased by the ripe fruit being left on them. Gather herbs for drying; also garlic, onions, and eschalots as the tops die down.

FLOWER GARDEN.

To make the flower-beds gay and attractive during the autumn and winter months is not a matter of great difficulty. Prepare a few shallow boxes. Make a compost, a great part of which should consist of rotten leaves. Fill the boxes with the compost; then sow thinly the seeds of annuals. Keep the surface of the soil moist, and when the young seedlings are large enough to handle, lift them gently one by one with a knife or a zinc label—*never pull them up by hand*, as, by so doing, the tender rootlets are broken, and little soil will adhere to the roots. Then prick them out into beds or boxes of very light soil containing plenty of leaf mould. Keep a sharp lookout for slugs and caterpillars.

All kinds of shrubby plants may be propagated by cuttings. Thus, pelargoniums, crotons, coleus, and many kinds of tropical foliage plants can be obtained from cuttings made this month. After putting out cuttings in a propagating frame, shade them with a piece of calico stretched over it. Be careful not to over-water at this season. Propagate verbenas, not forgetting to include the large scarlet fox hunter. Verbenas require rich soil. Palms may be planted out this month. If the weather prove dry, shade all trees planted out. With seed-boxes, mulch, shade, water, and kerosene spray, all of which imply a certain amount of morning and evening work, the flower garden in autumn and winter will present a charming sight.

Readers are reminded that a cross in the prescribed square on the first page of this "Journal" is an indication that their Subscription —one shilling for the current year is now due. The "Journal" is free to farmers and the shilling is merely to cover the cost of postage for twelve months. If your copy is marked with a cross please renew your registration now. Fill in the order form on another page of this issue and mail it immediately, with postage stamps or postal note for one shilling, to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Orchard Notes for January.

THE COASTAL DISTRICTS.

All orchards, plantations, and vineyards should be kept well cultivated and free from weed growth; in the first place, to conserve the moisture in the soil, so necessary for the proper development of all fruit trees and vines; and, secondly, to have any weed growth well in hand before the regular wet season commences. This advice is especially applicable to citrus orchards, which frequently suffer from lack of moisture at this period of the year if the weather is at all dry, and the young crop of fruit on the trees is injured to a greater or less extent in consequence.

Pineapple plantations must also be kept well worked and free from weeds, as when the harvesting of the main summer crop takes place later on, there is little time to devote to cultivation. If this important work has been neglected, not only does the actual crop of fruit on the plants suffer, but the plants themselves receive a setback.

Banana plantations should be kept well worked, and where the soil is likely to wash badly, or there is a deficiency of humus, a green crop for manuring may be planted. Should the normal wet season set in, it will then soon cover the ground without injury to the banana plants. When necessary, banana plantations should be manured now, using a complete manure rich in potash and nitrogen. Pineapples may also be manured, using a composition rich in potash and nitrogen, but containing no acid phosphate (superphosphate) and only a small percentage of bonemeal, ground phosphatic rock, or other material containing phosphoric acid in a slowly available form.

Bananas and pineapples may still be planted, though it is somewhat late for the former in the more southern parts of the State. Keep a good lookout for pests of all kinds, such as Maori on citrus trees, scale insects of all kinds, all leaf-eating insects, borers, and fungus pests generally, using the remedies recommended in Departmental publications.

Fruit fly should receive special attention, and on no account should infested fruit of any kind be allowed to lie about on the ground to become the means of breeding this serious pest. If this is neglected, when the main mango crop in the South and the early ripening citrus fruits are ready, there will be an army of flies waiting to destroy them.

Be very careful in handling and marketing of all kinds of fruit, as it soon spoils in hot weather, even when given the most careful treatment. Further, as during January there is generally more or less of a glut of fresh fruit, only the best will meet with a ready sale at a satisfactory price.

Grapes are in full season, and in order that they may be sold to advantage they must be very carefully handled, graded, and packed, as their value depends very much on the condition in which they reach the market and open up for sale. Well-coloured fruit, with the bloom on and without a blemish, always sells well, whereas badly coloured, immature, or bruised fruit is hard to quit.

One of the greatest mistakes in marketing grapes is to send the fruit to market before it is properly ripe, and there is no better way to spoil its sale than to try and force it on the general public when it is sour and unfit to eat.

Bananas for sending to the Southern States require to be cut on the green side, but not when they are so immature as to be only partially filled. The fruit must be well filled but show no sign of ripening; it must be carefully graded and packed and the cases marked in accordance with the regulations under the Fruit Cases Acts and forwarded to its destination with as little delay as possible.

Pineapples should be packed when they are fully developed, which means that they contain sufficient sugar to enable the fruit to mature properly. Immature fruit must not be marketed, and if an attempt is made to do so the fruit is liable to seizure and the sender of the fruit to prosecution under the abovenamed regulations. Further, the fruit must be graded to size and the number of fruit contained in a case must be marked thereon. Immature fruit must not be sent. For canning, the fruit should be partly coloured; immature fruit is useless; and overripe fruit

is just as bad. The former is deficient in colour and flavour and the latter is "winey" and of poor texture, so that it will not stand the necessary preparation and cooking.

Should there be a glut of bananas, growers are advised to try and convert any thoroughly ripe fruit into banana figs.

The fruit must be thoroughly ripe, so that it will peel easily, and it should be laid in a single layer on wooden trays and placed in the sun to dry. If the weather is settled, there is little trouble, but if there is any sign of rain the trays must be stacked till the weather is again fine, and the top of the stack protected from the rain. To facilitate drying, the fruit may be cut in half lengthways. It should be dried till a small portion rubbed between the finger and thumb shows no sign of moisture. It can be placed in a suitable box to sweat for a few days, after which it can be dipped in boiling water to destroy any moth or insect eggs that may have been laid on it during the process of drying and sweating. It is then placed in the sun to dry off any moisture, and when quite dry it should be at once packed into boxes lined with clean white paper. It must be firmly packed, when, if it has been properly dried, it will keep a considerable time. It can be used in many ways, and forms an excellent substitute for raisins, sultanas, currants, or other dried fruits used in making fruit cakes and other comestibles. Banana figs will be found useful for home consumption, and it is possible that a trade may be built up that will absorb a quantity of fruit that would otherwise go to waste.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

January is a busy month in the Granite Belt, and orchardists are fully occupied gathering, packing, and marketing the crop of midseason fruits, consisting of plums of several kinds, peaches, nectarines, pears, and apples. The majority of these fruits are better keepers and carriers than those that ripen earlier in the season; at the same time, the period of usefulness of any particular fruit is very limited, and it must be marketed and disposed of with as little delay as possible.

With the great increase in production, owing to the large area of new orchards coming into bearing and the increasing yields of those orchards that have not come into full profit, there is not likely to be any market for immature or inferior fruit. There will be ample good fruit to fully supply the markets that are available and accessible. Much of the fruit will not carry far beyond the metropolitan market, but firm-fleshed plums, clingstone peaches, and good firm apples should stand the journey to the Central, and, if they are very carefully selected, handled in a manner to prevent any bruising, and properly graded and packed, they should carry as far as Townsville. Growers must remember that, given a market fully supplied wtih fruit, only such fruit as reaches that market in first-class condition is likely to bring a price that will pay them; consequently the grower who takes the trouble to send nothing but perfect fruit, to grade it for size and colour, to pack it carefully and honestly, placing only one sized fruit, of even quality and even colour, in a case and packing it so that it will carry without bruising, and, when opened up for sale, will show off to the best advantage, is pretty certain of making good. On the other hand, the careless grower who sends inferior, badly graded, or badly packed fruit is very likely to find when the returns for the sale of his fruit are to hand, that after paying expenses there is little, if anything, left. The expense of marketing the fruit is practically the same in both cases.

Then "why spoil the ship for the ha'p'orth of tar" after you have gone to the expense of pruning, spraying, manuring, and cultivating your orchard? Why not try and get a maximum return for your labour by marketing your fruit properly? The packing of all kinds of fruit is a fairly simple matter, provided you will remember—

(1) That the fruit must be fully developed, but yet quite firm when gathered.

(2) That it must be handled like eggs, as a bruised fruit is a spoilt fruit, and, when packed with sound fruit, spoils them also.

(3) That only one-sized fruit, of an even degree of ripeness and colour, must be packed in a case.

(4) That the fruit must be so packed that it will not shift, for if it is loosely packed it will be so bruised when it reaches its destination that it will be of little value. At the same time, it must not be packed so tightly as to crush the fruit.

If these simple rules are borne in mind, growers will find that much of the blame they frequently attribute to the fruit merchants or middlemen is actually the result of their own lack of care. Fruit that opens up in the pink of condition sells itself, whereas any fruit that opens up indifferently is hard to sell on any except a bare market, and on a glutted market is either unsaleable or realises such a poor price that the grower is frequently out of pocket and would have been better off had he not attempted to market it.

If spraying with arsenate of lead, and systematic bandaging, has been properly carried out, there will be comparatively few codlin moths to destroy the later ripening pip fruits; but if these essential operations have been neglected or carelessly carried out a number of moths will hatch out and the eggs laid by them will turn to larvæ that will do much damage, in some cases even more than that caused by the first broods that attack the fruit as soon as it is formed. Where there is any likelihood, therefore, of a late crop of moths, spraying with arsenate of lead must be continued if the late crop of pip fruits is to be kept free from this serious pest.

Fruit fly must be systematically fought, and on no account must any fly-infected fruit be allowed to lie about on the ground and breed this pest, to do further damage to the later ripening fruits.

Citrus orchards will need to be kept well cultivated in the drier and warmer parts of the State, and, where necessary, the trees should be irrigated. If scale insects are present, the trees should be either sprayed, or, better still, treated with hydrocyanic acid gas.

Western grapes are in full season, and if they are to be sent long distances by rail then they are all the better to be cut some hours before they are packed, as this tends to wilt the stems and keep the berries from falling off in transit. The fruit must be perfectly dry when packed, and should be as cool as possible. It must be firmly packed, as a slack-packed case always carries badly and the fruit opens up in a more or less bruised condition.

Farm Notes for January.

FIELD.—The main business of the field during this month will be ploughing and preparing the land for the potato and other future crops, and keeping all growing crops clean. Great care must be exercised in the selection of seed potatoes to ensure their not being affected by the Irish blight. Never allow weeds to seed. This may be unavoidable in the event of long-continued heavy rains, but every effort should be made to prevent the weeds coming to maturity. A little maize may still be sown for a late crop. Sow sorghum, imphee, Cape barley, vetches, panicum, teosinte, rye, and cowpeas. In some very early localities potatoes may be sown, but there is considerable risk in sowing during this month, and it may be looked upon merely as an experiment. Plant potatoes whole. Early-sown cotton will be in bloom.

On coastal and intercoastal scrub districts, where recently burnt-off scrub land are ready for the reception of seed of summer-growing grasses, sowing may commence as soon as suitable weather is experienced. Much disappointment may be saved, and subsequent expenditure obviated, by ensuring that only good germinable grass seed is sown, of kinds and in quantities to suit local conditions, the circumstances being kept in mind that a good stand of grass is the principal factor in keeping down weeds and undergrowth.

In all districts where wheat, barley, oats, canary seed, and similar crops have recently been harvested, the practice of breaking up the surface soil on the cropped areas should invariably be adopted. Soil put into fit condition in this way will "trap" moisture and admit of the rains percolating into the subsoil, where the moisture necessary for the production of a succeeding crop can be held, provided attention is given to the maintenance of a surface mulch, and to the removal, by regular cultivation, of volunteer growths of all kinds. If not already seen to, all harvesting machinery should be put under cover, overhauled, and the woodwork painted where required.

Where maize and all summer-growing "hoed" crops are not too far advanced for the purpose, they should be kept in a well-cultivated condition with the horse hoe. Young maize and sorghum crops will derive much benefit by harrowing them, in the

same direction as the rows are running, using light lever harrows with the tines set back at an angle to obviate dragging out of plants, but the work should not be done in the heat of the day.

Quick-maturing varieties of maize and sorghum may still be sown in the early part of the month in coastal areas where early frosts are not expected.

Succession sowings may be made of a number of quick-growing summer fodder crops—Sudan grass, Japanese and French millet, white panicum, and liberty millet (panicum). In favourable situations, both "grain" and "saccharine" sorghums may still be sown; also maize, for fodder purposes.

Fodder conservation should be the aim of everyone who derives a living from stock, particularly the dairyman; the present is an important period to plan cropping arrangements. Exclusive of the main crops for feeding-off (when fodder is suitable for this purpose), ample provision should be made for ensilage crops to be conserved in silo or stack. As natural and summer-growing artificial grasses may be expected to lose some of their succulence in autumn, and more of it in winter and early spring, the cropping "lay-out" to provide a continuity of succulent green fodder throughout the season calls for thorough and deep cultivation and the building up of the fertility and moisture-holding capacity of the soil. Planter's friend (sorghum) may be sown as a broadcast crop at the latter end of the month for cutting and feeding to cattle in the autumn and early winter. Strips of land should be prepared also for a succession sowing about the second week in February, and for winter-growing fodder crops.

THE STORY OF PNEUMATIC TYRES.

It is exactly forty years ago since John Boyd Dunlop applied for the patent for the first pneumatic tyre. He had just retired from his veterinary practice in Belfast, the largest one in Ireland, where twelve horse-shoers worked for him.

While a boy at school in the village of Dreghorn, Ayrshire, his native place, Dunlop observed that a large wooden roller was easier to pull than a smaller one, because, as it had a larger area of surface bearing on the ground, the pressure on each unit of area was less.

For years he thought on the idea of wheels with flexible rims that would flatten out and so increase the area of contact with the road. It was a complaint from his small son Johnny, then nine years of age, which actually materialised in the first rubber tyres to be filled with air. Johnny had grumbled about the difficulty of riding on thin solid tyres over the uneven stone setts of Belfast's streets.

His father thereupon made two air tubes from sheet rubber one thirty-second of an inch thick, fixed them to a wooden disc with a thin strip of linen, and blew them up with a football pump. The tyres were then fitted to a tricycle made by Dunlop from American elm to his own design with specially shaped rims. The whole was completed one night at ten o'clock, and so eager were both father and son to test the new device that the boy went out for a run in the moonlight and returned triumphant at midnight.

When a racing cyclist who was shown the novelty expressed his doubts about it, the inventor challenged him to a race on his thin solid tyres against the nine-year-old boy on the home-made tricycle equipped with pneumatics. It was the first of the unending tale of races to be won on Dunlops. Although John Boyd Dunlop revolutionised cycling, and made motor cars possible, he himself could not at that time ride a bicycle; indeed, there is no record that he ever rode one all his life.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	December, 1928.		January, 1929.		Dec., 1928.	Jan., 1929.
					MOONRISE.	
Date.	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	4.50	6.32	5.1	6.49	30.44	11.14
2	4.50	6 32	5.2	6.49	11.10	11.43
3	4.50	6.33	5.3	6.49	...	...
					a.m.	a.m.
4	4.50	6.34	5.3	6.50	12.8	12 13
5	4.50	6.35	5.4	6.50	12.41	12.43
6	4.50	6.35	5.5	6.50	1.12	1.15
7	4.50	6.36	5.6	6.51	1.42	1.48
8	4 50	6.36	5.6	6.51	2.12	2.26
9	4.50	6.37	5.7	6.51	2.41	3 10
10	4.51	6.38	5.8	6.51	3.15	3.58
11	4.51	6.39	5.9	6.51	3.48	4.51
12	4.51	6.40	5.9	6.51	4.28	5.44
13	4.51	6.40	5.10	6.51	5.14	6.41
14	4.52	6.41	5.11	6.51	6.3	7.40
15	4.52	6.41	5.12	6.51	6.56	8.37
16	4.52	6.42	5.13	6.51	7.50	9.36
17	4.52	6.43	5.13	6.51	8.46	10.34
18	4.53	6.43	5.14	6.51	9.46	11.33
					p.m.	p.m.
19	4.53	6.44	5.15	6.51	10.43	12.34
20	4.54	6.44	5.16	6.50	11.49	1.38
					p.m.	
21	4.54	6.45	5.16	6.50	12.40	2.46
22	4.55	6.46	5.17	6.50	1.42	3.56
23	4.55	6.46	5.18	6.49	2.47	5.3
24	4.56	6.47	5.19	6.49	3.55	6.7
25	4.56	6.47	5.19	6.49	5.8	7.4
26	4.57	6.47	5.20	6.48	6.17	7.53
27	4.57	6.48	5.21	6.48	7.24	8.32
28	4.58	6.48	5.22	6.48	8.26	9.10
29	4.59	6.48	5.23	6.47	9.19	9.41
30	5.0	6.49	5.24	6.47	10.2	10.13
31	5·0	6.49	5.25	6.47	10.40	10.43

Phases of the Moon, Occultations, &c.

The times stated are for Queensland, New South Wales, Victoria, and Tasmania.

4 Dec.	☽ Last Quarter	12	31 p.m.
12 ,,	● New Moon	3	6 p.m.
20 ,,	☾ First Quarter	1	43 p.m.
27 ,,	○ Full Moon	5	54 a.m.

Apogee, 11th December, at 7 18 p.m.
Perigee, 26th December, at 12 30 p.m.

The Moon when making a complete revolution about the earth in December will, apparently, be among the stars of Cancer on the 1st and 2nd, of Leo on the 3rd and 4th, of Virgo from the 5th to the 8th, of Libra from the 8th to the 10th, of Scorpio on the 10th and 11th, of Orphiucus on the 12th and 13th, of Sagittarius from the 14th, to 16th, of Capricornus on the 17th and 18th, of Aquarius on the 19th, of Pisces on the 20th, of Cetus on the 20th and 21st, of Pisces on the 21st, of Aries on the 23rd and 24th, of Taurus from the 24th to 26th, of Gemisis on the 27th and 28th, of Cancer on the 28th and 29th, and of Leo on the 30th and 31st.

When apparently in Leo on the 3rd and again on the 30th the Moon will pass within 5 degrees of Neptune, which is still near Regulus, but invisible without a telescope.

Saturn and Mercury will be passed on the 12th when the Moon is new and invisible.

On the 16th, when passing Venus about 9 a.m., an interesting daylight spectacle may be obtained, the crescent Moon and the beautiful planet being in the east-south-east.

On the 26th the Moon will occult Mars about the time of rising; and a small star in Taurus about an hour or so later.

Mercury will be on the far side of its orbit almost directly behind the Sun on the 18th, and only one degree above its upper edge at noon; it will therefore not be noticeable this month.

Venus will set at 9·23 p.m. on the 1st and at 9·35 p.m. on the 15th.

Mars will rise at 8·36 p.m. and set at 6·18 p.m. on the 1st. On the 15th it will rise at 7·20 p.m. and set at 5·29 a.m.

Jupiter will rise at 3·34 p.m. and set at 2·48 a.m. on the 1st. On the 15th it will rise at 2·33 p.m. and set at 1·53 a.m.

Saturn will rise at 5·58 a.m. and set at 8·30 p.m. on the 1st; it will be in conjunction with the Sun on the 13th and therefore rise and set with it.

3 Jan.	☽ Last Quarter	4	34 a.m.
11 ,,	● New Moon	10	28 a.m.
19 ,,	☾ First Quarter	1	15 a.m.
25 ,,	○ Full Moon	5	9 p.m.

Apogee, 8th January, at 1·42 a.m.
Perigee, 23rd January, at 9.48 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhere about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.